

FLIGHT

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Founder and Editor: STANLEY SPOONER.

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EDITORIAL COMMENT.



IN a recent issue of the *Times* there appeared a most interesting and illuminative letter under this heading. It had, in its main incidence, only an indirect bearing upon the future of aviation, but the matter of air supremacy is so much a part of the whole of the questions involved that the letter will bear examination in that connection. The writer premises that there are numerous indications that after the war Germany will change her Imperial plans. As all the world knows, Germany began this war in the hope of destroying British naval power and establishing German world dominion on a basis of sea supremacy. This ambitious plan not only violated every tradition of Prussian policy, but was contrary to the most inspired teachings of Bismarck.

Bismarck was always a Continentalist, and to the end of his life remained a believer in the fact that Germany's destiny had Continental limits. He believed that if Germany was ever to hold world dominion it could only be with the active assistance of, and in alliance with, Holland, Austria, Russia and Italy. And there are ample signs that Germany, before many months have passed, may be compelled

to abandon her dreams of sea dominion and return to the theories of the Iron Chancellor. Within the past few months a German-Persian Union and a German-Chinese Union have been established. Nine months ago a prominent member of the Prussian Diet delivered a lecture to the members of the last-named organisation, the burden of which was that German world-empire could be established only on a basis of an overland dominion extending from the North Sea to China by way of Turkey and Persia. The speaker argued that after the war there would come an era of commercial strife, and that many of the world's markets would be more or less closed to Germany. In any future war the British Navy would be able even more effectively than now to prevent raw material and foodstuffs reaching Germany from the Americas. A British blockade, however, could be rendered absolutely ineffective if Germany controlled the ancient highway from Europe to the East known as the "Silk Street." Persia and China could easily provide the legions of 1927—the date of Germany's next attempt—with all the food, petrol, copper and cotton required finally to establish the Teuton as the master of Europe and Asia.

It is known that at the present moment Germany is busily negotiating for valuable railway, canal and trading concessions in China; that her system of commercial and political espionage has been strengthened and ramified throughout the whole of Siberia, in the Ukraina, from the Black Sea through Irkutsk and Teheran to the Far East; and that the powerful Siemens Combine, which owns all the rich copper ores in the Caucasus and in Armenia, has recently sent bodies of specially trained experts through Persia with the object of discovering and opening up new sources of mineral wealth. A mere cursory perusal of the "Veröffentlichungen des Reichskolonialamtes" at Berlin ("Publications of the Berlin Colonial Office") for 1916 is sufficient to prove that the German authorities are not only alive to the commercial possibilities of this new idea, but also to its political and military value, for these publications contain frequent reports of Asiatic exploitation and point out the important results, commercial and strategic, which will accrue.

Martin, the Prussian writer and Privy Councillor, in a remarkable book entitled "Berlin-Baghdad," published in 1907, declared that Germany's future "lies in Asia and in the air." Perhaps the most significant chapters in this book are those which contain a close and clever exposition of the strategical value of the region between the Altai and the Himalaya Mountains, known as the Gobi Desert. This

region is spoken of as the "key of Asia" and the "central tableland of the Old World." Martin states that were Germany to control this vast plateau it could be developed into the most formidable air-base in the world. A thousand super-Zeppelins could be stationed there. India could be threatened on the one side, Russia on the other. But Germany must be "first in the air." Then, and only then, will she be able to "hold the principal overland route to the East" and to "establish her transcontinental empire."

The reply to these ambitious projects, in the opinion of the *Times* correspondent, is the isolation of Germany. England, on the other hand, must strengthen and consolidate her foreign alliances, and, with the help of Russia, must cut across the "Silk Street." She must be first in the air, as on the sea, and she must do in Persia as she has done in India. Most necessary of all, she must capture control—and that immediately—of the Gobi Plateau, the key of the Old World, thus securing it as the future base of an Anglo-Russian air police.

Light on the German Ideal.

The letter is a remarkable one for the attention it directs to the hard-dying ideals of German world dominion. It impresses the fact that although the responsible people of Germany realise now that the objects for which she plunged the world into the bloodiest war of history are unattainable now, the ambition to try again has by no means been scotched by failure. If any argument were needed why we should not listen to the specious voice of the peace charmer until we have achieved to the full the task to which we set ourselves in 1914, it would surely be supplied by the speeches of German public men. What is vital to the future of the German plans for the domination of the world is that there should be peace before the Hun Empire has been bled white by the sacrifices of war. Germany must have a breathing space—an interval for recuperation before embarking upon yet another venture, even more desperate than the present. We need not, for the purposes of this part of the argument, discuss the means by which the Germans hope to achieve a belated success for their schemes of world-empire. It is quite sufficient that the dream lives on, and for us to entertain any thoughts of a peace that would leave Germany with the means to pursue her ideals would be the merest folly. We must go on to the bitter end.

The Domination of Asia.

The dominion of the East as an alternative to that of the sea is attractive to the German Imperialist, the more so as the idea has more of the practical in it than the other. But it is curious to regard the manner in which the German method of thought is apt to take no stock of the major difficulties in the way of accomplishment of the plan that appeals to it. So far as the control of "Silk Street" is concerned, that is feasible enough, always supposing that Britain and Russia are content to stand by and see that control filched from them. We have also to suppose an amenable Turkey and a passive Persia. The Hun fails to take any account of the strong possibility that by the time the reckoning for this war has been paid, Germany's present allies may have had more

than enough of the association. Furthermore, it is perfectly easy to talk about the control of the Gobi and its use as a base for "a thousand super-Zeppelins." The simple fact that the Gobi happens to be Chinese can hardly be expected to affect the case! China would, naturally, welcome the Hun with open arms, and would cede such a vast territory without the slightest demur in exchange for all the manifold benefits of Germanic "kultur"! The fact, too, that China is to have the privilege of providing the "legions for 1927" would doubtless add to the attractiveness of the proposition!

While the megalomaniac vapourings of these German publicists incline us to laughter, it will not do to lose sight of the obvious fact that there is a good deal of practicality behind them. In aiming for the unattainable it is often possible to achieve something. Therefore, we shall do well not to ignore altogether the Eastern threat, for threat it is. We know that the Germans are intriguing in every country of Asia, and most of all in China. It is for us, then, to take prompt and vigorous measures for combatting those intrigues. But we hesitate to endorse the policy advocated by the correspondent of the *Times* that we should at once "capture control of the Gobi plateau" and use it as a base for an Anglo-Russian air-police. Does he want us to embark upon a war with China for its possession? That is what the proposition means.

However, we may leave the politics of the question to be elucidated by others and confine ourselves to the air. It emerges that Germany, with her usual far-sightedness, realises that supremacy in the air is vital to all schemes of attack or defence. Whether that supremacy is to be obtained and held by the possession of the Gobi desert or by any other means does not affect the main principle, which is that air supremacy will in the future mean world supremacy. That is what we are concerned with at the moment, and it is with that that we must concern ourselves in the future. There is no need to elaborate the point now. It is absolutely plain for us to read as we run. An air fleet as supreme as the Navy is at sea—nothing short of that will serve our case—is what we have to aim at now and in the future of "after the war."

Prussianism Run Riot.

On several occasions of late we have felt impelled to express a growing sense of disquietude, consequent upon official abuse of the powers conferred by that far-reaching measure, the Defence of the Realm Act. That Act was passed by Parliament in a time of national crisis, when it was essential that the Government of the day should be invested with the widest possible powers to enable it to deal adequately with the greatest emergency in history. It was a necessary measure, and we ourselves would be the last to complain of the extraordinary powers conferred by it if those powers were wielded properly and with a due sense of responsibility. Unfortunately, that has not been the case. In too many instances the Defence of the Realm Act has been made the vehicle and the excuse for exhibitions of official crassitude and tyranny which, in ordinary times and under normal circumstances, would have been sufficient to have brought about something dangerously near to a serious upheaval. The favourite pose of the official is that he is the master and the public his servant,



Air Supremacy Spells World Supremacy.
The Premature Peace Menace. Hun World ambitions—"be warned in time."

to fetch and carry as he orders. In ordinary times it is possible to keep a check on the jack-in-office, but with the Defence of the Realm Act at his back the position is an entirely different one. The public is helpless, and the official, from the highest to the lowest, has it all his own way, with the consequence that we are in danger of becoming more Prussianised even than the Prussians themselves.

If a moral were needed to point the argument we have only to regard the outrage perpetrated by officialdom on Sir Theodore Cook last week. We do not propose to recapitulate the whole story. We have seen Sir Theodore's statement of the facts that led up to the raid on his office, and the lame official *communiqué* purporting to be an answer to that statement, and, taking the one with the other, we cannot recall anything in a long experience which has left a worse taste than the outrageous story disclosed of officialism run riot. We use the term outrageous advisedly, because whatever the rights and wrongs of the case—and until we know both sides we cannot pronounce judgment on Lord Moulton and the War Office in the matter of their attitude to the invention—the hole-and-corner methods of the officials and their systematic persecution of Sir Theodore Cook and his associates reads more like a story of the Inquisition under Torquemada than of England in the twentieth century. Persecution is almost too mild a word to use in describing the methods of the "authorities"—save the mark!

It seems to us to be a great pity that in Sir Theodore's letter the *Times* has contented itself with describing the officers concerned in this most unsavoury case by letters of the alphabet. Unless there is some very good reason to the contrary, we think it would have strengthened the case if the public had been told their names. They will have to come out sooner or later, and the sooner the better. Obviously, the matter cannot be allowed to rest where it is. It is not one for "investigation by the proper authority," to quote the words of the Press Bureau communication. It is emphatically one for the most searching public enquiry by a thoroughly independent and impartial tribunal, so that we may be sure of arriving at the hidden motives that lie behind the official action. Until such an enquiry has been held and the very fullest light shed upon the whole affair there must remain a feeling in the public mind that there is something behind it all that will not bear the light of day. The British public is a long-suffering one. It has been content to surrender its liberties for the time being, and to accept without question the behests of its appointed rulers, but there are limits even to its endurance, and it will not need many such cases as this to stretch that endurance to something approaching the limit. Officialdom at large will do well to remember that, even while the Defence of the Realm Act is in operation, it is the servant of the public which has to pay for its services. Ultimately it is he who pays the piper who calls the tune.

Over and above the question of the outrageous violation of private rights, there arises that of the public interest. The powder in which Sir Theodore Cook is interested is either a good thing or it is not. It has been well reported upon by the British Trench Warfare Department and the Aeronautical Department of the French Government. That at least supplies a reason why its claims should have received the very fullest investigation, rather than that the War Office should have embarked upon a totally

inexplicable campaign of persecution of those who appear to have had no thought in mind save the introduction of this powder to the proper quarter. Sir Theodore himself puts the question very appositely when he asks: "Shall this powder be used to kill Germans or shall it not? Does it promise greater safety in manufacture than other powders now employed?"

Clearly, if it can be established—and Sir Theodore apparently claims that it can—that this powder will kill Germans more effectively than any other, the answer to the first part of the question is a most emphatic affirmative. Given that this is so, the second part of the question may be modified to this extent: that if it can be manufactured with *equal* safety, it must be adopted.

**The
President
Again!**

Once again President Wilson has butted in on the question of peace. This time he has busied himself by laying down the American ideal of the perfect world in which there shall be no more war and in which nations and men shall be free to pursue the almighty dollar without thought or care for the mere considerations of national honour or human ideals. He has gone farther afield and told the world that the present war must be ended, and the peace must be one which will win the approval of mankind, not merely serve the interests and aims of the belligerents, and he makes the astounding statement that the assurances given by statesmen of both groups of nations imply first of all that there must be a "peace without victory."

We are frankly becoming very tired of the clap-trap of this egregious person. In his latest effusion he enunciates ideals for the welfare of mankind for which England has stood for the past hundred years and more. That they are a new discovery in the land of the dollar only remotely concerns us, except that we resent the smug complacency which claims originality for them. But when the President becomes specific and starts to tell the world what America wants and of how America is more or less going to settle the terms of peace, then we are very directly concerned. Surely, it ought to have entered his understanding by this time that the peace we shall make will be our peace and that we shall tolerate no interference from America or from any other nation which has had no lot or part in the achievement of the results upon which that peace is based. If Americans are too proud to fight, we are too proud to seek or accept their aid at the council table, and the sooner this is understood on the other side of the Atlantic the better for our future relations. When President Wilson speaks of statesmen of both groups whose assurances imply peace without victory, he becomes grossly impertinent, in that he gives the lie direct to every responsible statesman of the Entente Powers. In no single instance, on no single occasion, has any Allied statesman foreshadowed a peace which should be based on anything but the defeat of the Hun. That is quite sufficient answer to this meddlesome personage. Peace only after victory, and peace on terms satisfactory to us and our Allies, without reference to neutrals. That is what we mean to achieve. The neutral nations, save possibly America, are to the full cognisant of Allied aims and ideals, and they know the peace on our basis is the peace they themselves desire.

NEW CLUBS FOR OLD.

By THE SAME CLUB MEMBER.

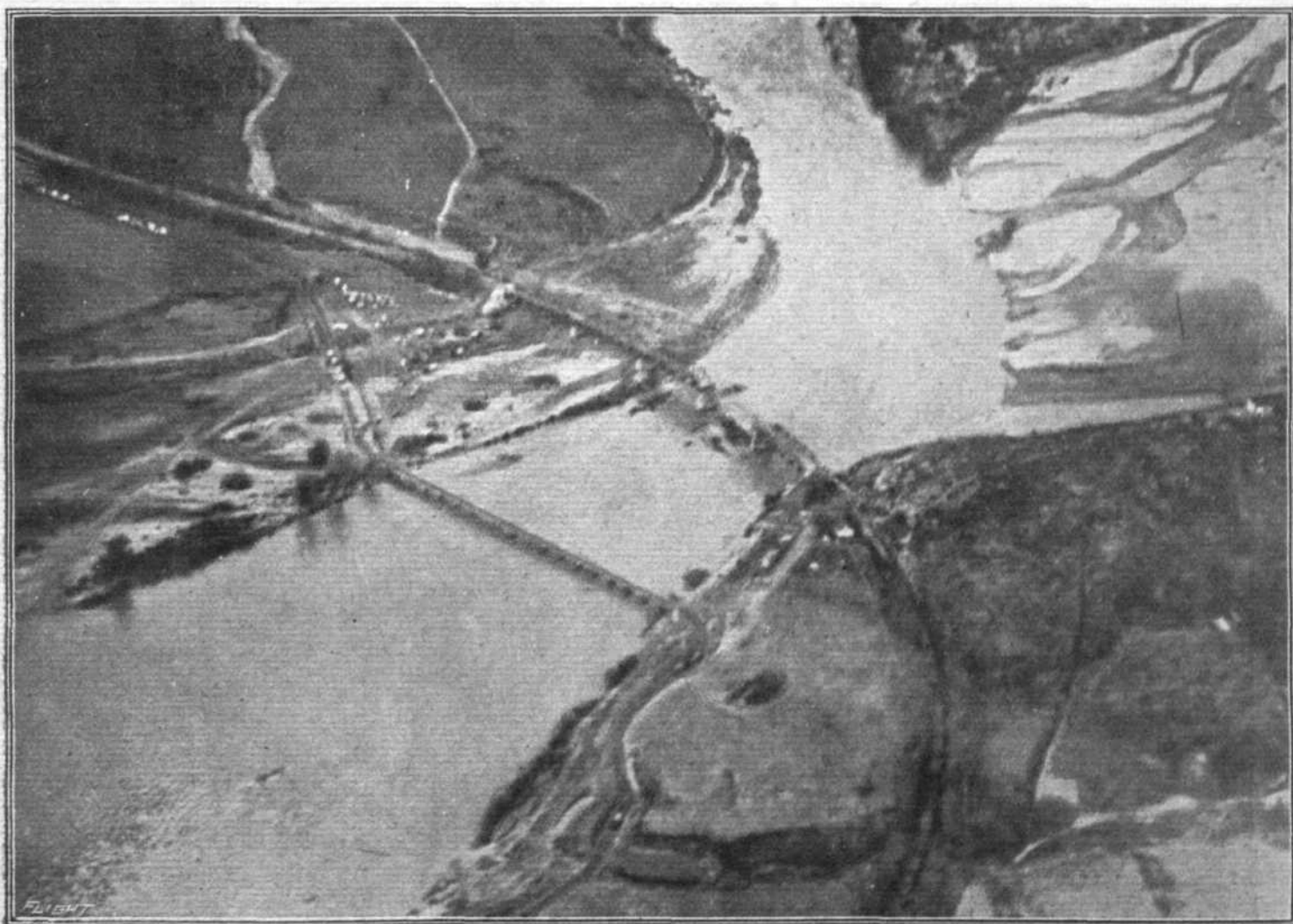
HAVING paid the humble tribute of what my immaculate friend calls my Venomous Pen—really it is a Waterman self-starter—to the passing of the old premises of the Royal Aero Club, perhaps the Editor will permit me to record my first impressions of Number Three, Clifford Street. I returned from a tour in the frozen north a few nights ago, and instinctively made my way to the new address, as advertised weekly in "FLIGHT" for some time past.

On entering the front door I found myself in a handsome hall, replete, as estate agents would say, with every modern convenience. There were lounges and armchairs richly upholstered, a grandfather's clock, which was full of dignity and had a special daylight-saving scheme of its own—being seven hours fast—and the largest fire I have seen burning since the beginning of the war, except once in a munition worker's cottage near Sheffield. On several hat-stands were displayed a dozen or so of the best assorted khaki caps, as now worn, some of them of the Staff kind—you know them by the little red band—and a beautiful fur coat. I saw the latter first, and thinking I had strayed into the Vaudeville Club by mistake I retreated towards the door. The familiar face of the porter, however, coupled with the sight of a notice-board covered with telegrams awaiting Flight-Commander So-and-So, reassured me. I went outside, and having carefully wiped my

feet on the mat I gently and modestly re-entered the building.

There are lovely carpets everywhere, as soft as Chingford Aerodrome only not so juicy, and offering a splendid landing surface. The new club is a fine specimen of a Georgian dwelling-house. I don't mean Lloyd Georgian, but one of the earlier ones. I don't know which one, but he came in among the first three all right. There is no wall-paper. The walls are all pannelled. How old they are I am not able to say, but they got over their first attack of distemper quite 70 or 80 years ago. Conveniently situated near the top of the first staircase is a very attractive apartment. There are Cromwellian armchairs, Jacobean lounges, and stools with glass roofs whereon to rest one's feet, matches or cocoa. There is a delightful cushioned window-seat, whence the eye would probably roam over fair pastures and ancient oaks. I could not say for certain as the heavy silken curtains were closely drawn, lest perchance some wandering Zepp. should catch a glimpse of the luxury in which those connected with British aviation spend their leisure hours, and, impatiently flinging a bomb, injure the Burlingtonian hostelry or arcade near by.

There is also another Georgian fire-place, filled with more real coal, and ornamented with carvings of a female head and a German eagle; and there is also



(Official photograph issued by the Press Bureau.)

IN THE MEDITERRANEAN THEATRE OF WAR.—The destruction of a span of railway bridge in the possession of the enemy, as the result of a direct hit from a bomb dropped by naval airmen from an aeroplane at the height of 1,000 feet.

a bar, though I did not see this until I was leaving, as it was effectively concealed by a distinguished crowd of naval and military officers, very few having less than three stars or stripes.

From the stray fragments of conversation which I could not avoid overhearing, they were one and all discussing the present war, and the chances of having another. It must be an inestimable boon to the flying services to possess so attractive and convenient a meeting-place in which to discuss technical matters in this way.

We have a real reading-room, so comfortable and so ornamental that I cannot believe the papers and magazines will ever look untidy. We have other rooms, each more beautiful than the last, wherein to smoke, or chat, or calculate one's war profits or one's chances of promotion. Everything is provided for our convenience—even two dining-rooms, so that one may have the regulation three courses in the one and then adjourn for three courses more in the other. Small wonder that, on this particular evening, the member for Yorkshire, having dined well and ordered another large cigar, was lost in admiration of the architectural beauties of the place, enquired the name

of the panel doctor responsible for the elaborate carvings on all sides, and finally decided to engage a bedroom for the night. And even the rotund and jocular personage around whom the club chiefly revolves missed his last train and had to wait for the next.

The dinner was an excellent one, the cooking being unanimously passed for general service, and the quantity being as liberal as the Defence of the Pantry Act permits. It was easy to see that cheese, however strong, does not even count as a half-course, for all that remained of the Stilton was a large shell-hole surrounded by rind, although the club had only been open a week. The proprietors of the Bodega will be jealous.

In the upper regions are quiet, well-furnished bedrooms, for which there is already a good demand. In the basement there is a billiard-room. I went down there, with several others, during the evening. It was not yet completed, but, as Lord Robey of Bing would say, what *was* there—was good!

Altogether this is Some Club. We may well be proud of it, for there is none more cosy or more artistic to be found between Shoreditch Empire and Hammersmith Broadway.



Bar to D.S.O. for Commander Samson.

It was announced in the *London Gazette* of January 23rd that the King has been graciously pleased to give orders for the award of a Bar to the Distinguished Service Order of the undermentioned officer, in recognition of his continued gallantry and distinguished services as a Flying Officer:

Commander CHARLES RUMNEY SAMSON, D.S.O., R.N.
(Wing Commander, R.N.A.S.).

Military Medals for R.F.C.

In the list of awards published on January 22nd, of



the Military Medal for bravery in the field, the following appears:—

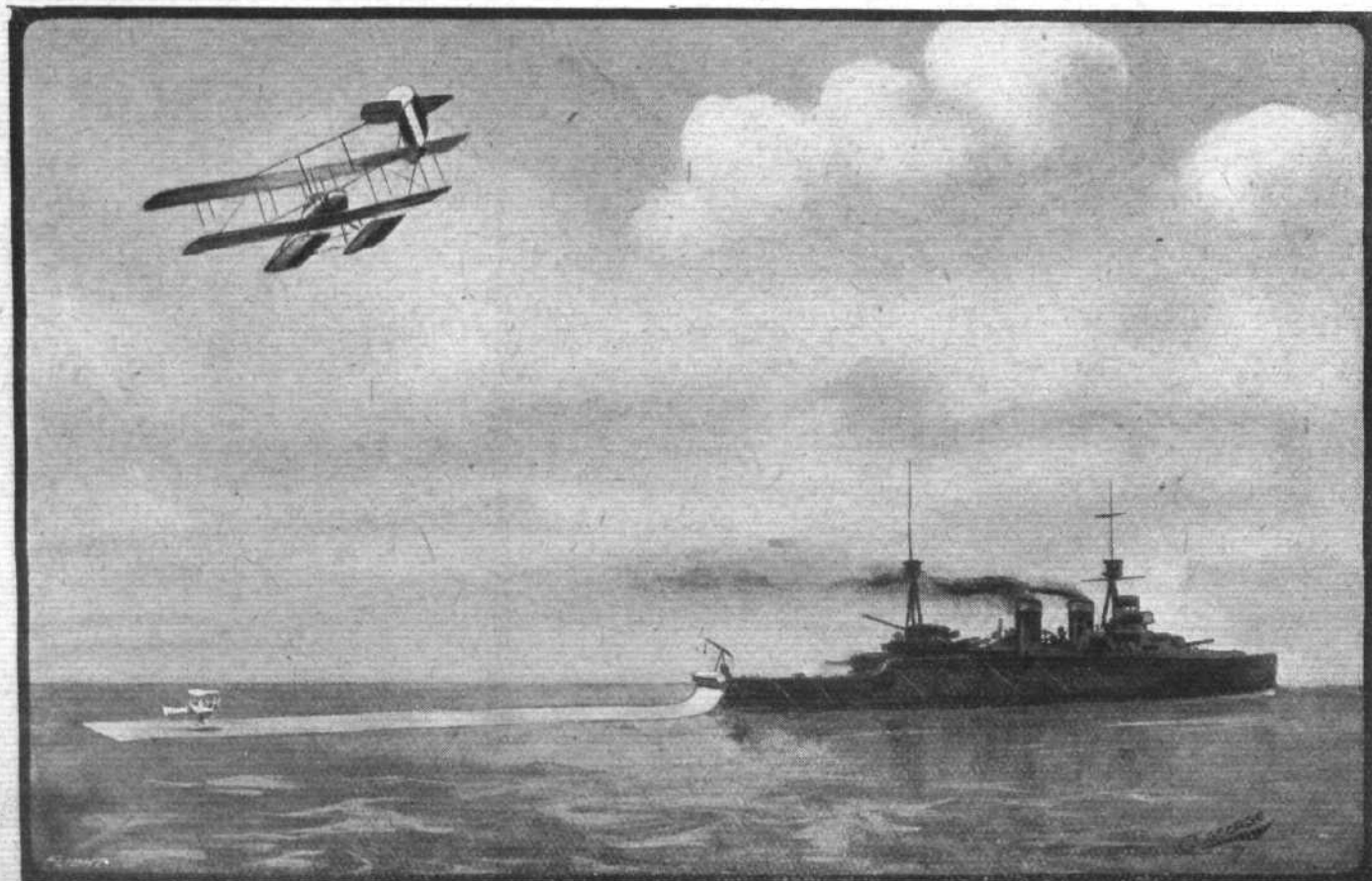
820 Flight-Sergt. A. HAMILTON, R.F.C.

2073 1st Class Air-Mech. O. F. WATTS, R.F.C.

Praise from General Smuts for Air Services.

In his despatch dealing with the campaign in East Africa up to October 27th, General Smuts says:—

"The work of the Air Services has been most creditable. In addition to their reconnaissance work there is evidence to the effect that both material and moral damage has been done to the enemy by their constant bombing raids."



The above drawing illustrates a flying officer's semi-humorous idea to facilitate sea-scouting by aeroplanes. The mother-ship carries at the stern a huge roll of flexible shutter made of wood or other tubes on the roll-top-desk principle. When let out this would float and trail behind the ship and would be used for getting off and landing by small scouts. As the ship steams slowly forward, the raft might, it is suggested, keep reasonably flat.

UNITS EMPLOYED IN RECORDING THE RESULTS OF WIND TUNNEL EXPERIMENTS.

IN spite of all that has been written on wind tunnel experiments, the nature of the units employed in presenting the results of these tests still remains a mystery to many of those who are daily taking a more direct interest in matters aviatric. This is increasingly evident from the number of enquiries we receive week by week upon the subject. A brief description and explanation of the various units may therefore be helpful in giving a better understanding of the precise nature of these "coefficients" that are constantly referred to in all matters dealing with the investigation of aeroplanes and their parts.

The experiments with a dropping apparatus carried out by Mons. G. Eiffel at the tower bearing his name have definitely proved that the resistance offered by a body passing through the air, or—what amounts to the same thing—by a stationary body placed in a current of air, can be expressed by the formula $R = KSV^2$, where S is the area of the surface—the area is taken as the actual area of a plate, either inclined or at right angles to the air current, and, in the case of a rounded body, as the area of the cross-section— V the velocity of the air current, and K a coefficient, depending on the form of the body, independent of V and increasing slightly with S . The unit resistance K is the resistance in kilogrammes offered by a solid body of 1 square metre area moving at a velocity of 1 metre per second in air of normal density. The normal density of air at 15° and a barometric pressure of 760 millimetres is 1,220.

In Eiffel's books the experimental results are all reduced to a velocity of 10 metres per second. If, for a certain body, the value of K is stated to be 0.05, the resistance of that body at a velocity of 1 metre per second is: $R = 0.05 \times 1 \times 1^2 = 0.05$ kilogrammes per square metre. At a velocity of 10 metres per second the resistance per square metre is of course, $0.05 \times 1 \times 10^2 = 5$ kilogrammes.

If the velocity is expressed in kilometres per hour, the co-efficient K must, if the formula is to "hold good," be altered accordingly. Thus, 10 metres per second = $10 \times 60 \times 60 = 36,000$ metres per hour = 36 kilometres per hour. Therefore, if V is 36 kilometres per hour, the coefficient K must obviously be multiplied by $\left(\frac{10}{36}\right)^2 = 0.077$. In the previous

example, if the velocity is expressed as 36 kilometres per hour instead of as 10 metres per second, the formula becomes: $R = 0.077 KSV^2 = 0.077 \times 0.05 \times 1 \times 36^2 = 4.9716$ kilogrammes per square metre. The slight discrepancy (from 5 to 4.9716) is, of course, due to the fact that only three decimal places were taken in the number 0.077.

If it is desired to employ this formula with English units (pounds per square foot and miles per hour), K must be multiplied by a certain number representing the difference between English and metric units. As one kilogramme = 2.2 lbs., 1 square metre = 10.76 sq. ft., and 1 kilometre per hour = 0.62 mile per hour, this number is obviously—as Eiffel's results are reduced to a velocity of 10 metres per second or 36 kilometres per hour— $0.2 \left(\frac{10}{22.3}\right)^2 = 0.0408$. For

purposes of conversion the formula then becomes: $R = 0.0408 \times KSV^2$, where K is the coefficient given in Eiffel's works, S the area in sq. ft., and V the velocity in miles per hour. Thus, if Eiffel gives the

coefficient for a certain plate or body as 0.05, the resistance per square foot of that body at a speed of 50 miles per hour is: $R = 0.0408 \times 0.05 \times 1 \times 50^2 = 5.1$ lbs.

As it is sometimes inconvenient to employ the original formula, owing to the care necessary in choosing the right units, it is frequently replaced by another which has the advantage that it is independent of the units employed. This formula is

written by Continental authorities as $R = z \frac{\delta}{g} SV^2$, in

which δ is the specific gravity of air, g the acceleration due to gravity, and z a coefficient depending only on the shape of the body. S and V , as before, represent the area and the velocity respectively. With Eiffel's

definition of K , $\frac{\delta}{g} = \frac{1.225}{9.81} = \frac{1}{8} = 0.125$. Therefore $z = 8K$. The quantity z in this equation, which, as will be shown presently, is generally indicated by the letter C in this country, is termed an "absolute" quantity, since it is independent of the units employed, so long, of course, as these are dynamically self-consistent.

In this country the same formula is usually written in a slightly different way—that is to say, the notation is different. Thus, in the annual reports of the Advisory Committee for Aeronautics, pressures and forces are recorded by tabulating the quantity C in the equations:—

$$P = C\rho v^2$$

$$F = CA\rho v^2$$

where P and F are the pressures and forces in whatever units of mass, length and time are employed, A is the area, ρ is the density of the air and v is the velocity. If it is desired to find the pressures in lbs. per square foot when v is in feet per second, the value of ρ is 0.00238. For example, if the "absolute" lift coefficient of a wing section is given in the N.P.L. reports as being 0.3, the lift per square foot of that section at, say, 100 ft. per second is found by substituting in the formula $P = C\rho v^2$, which gives: $P = 0.3 \times 0.00238 \times 100^2 = 7.14$ lbs./sq. ft. If it is desired to find the lift of the same wing section, and the speed is given in miles per hour instead of in feet/seconds, the value of ρ becomes 0.0051, and the lift per square foot at the same velocity as before, only expressed in miles per hour (1.46 ft./sec. = 1 m.p.h., therefore 100 ft./sec. = 68.4 m.p.h.) is: $P = 0.3 \times 0.0051 \times 68.4^2 = 7.14$ lbs. per sq. ft. When the loading is in kilogrammes per square metre and the velocity in metres per second, the value of ρ is 0.125. This corresponds, it will be seen, with the value of $\frac{1}{8}$ or 0.125 for $\frac{\delta}{g}$ in the French equation

$R = z \frac{\delta}{g} SV^2$, so that we have here proof of the similarity of the two formulæ. It will be seen that

$z = C$, $\frac{\delta}{g} = \rho = 0.125$, when the loading is in kilogrammes per square metre and the velocity in metres per second, = 0.0051 when the loading is in lbs./square feet and the velocity in miles per hour, = 0.00238 when the loading is in lbs. per square foot and the velocity in feet/second. It therefore follows that to convert Eiffel's coefficient K into the "absolute" coefficient C all that is necessary is to

multiply K by 8. In other words, $C = 8K$. For instance, if the lift coefficient of a certain wing section is given in Eiffel's works as 0.075, the corresponding "absolute" lift coefficient is $0.075 \times 8 = 0.6$.

In some cases the "absolute" lift coefficients are not used, but the lift in lbs./square feet at a velocity of 1 m.p.h. Thus, a lift per square foot of 0.00306 lb. obviously corresponds to an "absolute" lift coefficient of 0.6, since, by substituting in the equation for a velocity of 1 m.p.h., $P = 0.6 \times 0.0051 \times 1^2 = 0.00306$.

Again, the lift coefficients may be referred to a unit velocity of 1 ft./sec., in which case an "absolute" lift coefficient of 0.6 becomes $0.6 \times 0.00238 \times 1^2 = 0.001368$. This is, we believe, the unit employed in the book by Mr. F. S. Barnwell entitled "Aeroplane Design."

It is chiefly a matter of convenience which units to employ and, for the purpose of aeroplane

design, although the speed of an aeroplane is generally given in miles per hour, it will probably be found most convenient to use the feet/seconds units, since these are almost universally employed in all problems in kinematics and kinetics.

In conclusion, a brief summary for purposes of reference may not be out of place. In the books by Mons. G. Eiffel the experimental results, unless otherwise stated, are always reduced to a velocity of 10 metres per second. To convert these into "absolute" units, multiply by 8. To convert "absolute" coefficients into lbs. per square foot at v feet/seconds, multiply the "absolute" coefficient by $0.00238v^2$. To convert "absolute" coefficients into lbs./square feet at v miles per hour, multiply the "absolute" coefficients by $0.0051v^2$. To convert "absolute" coefficients into kilogrammes per square metre at v metres per second, multiply the "absolute" coefficient by 0.125.



LORD FRENCH ON ANTI-AIRCRAFT DEFENCES.

IN a report dated December 31st to the Secretary for War from Field-Marshal Viscount French, Commanding-in-Chief, Home Forces, published in the *London Gazette* of January 23rd, and dealing with the question of Home Defence, the following occurs:—

"At the time of my assumption of command the question of the anti-aircraft defences of the country was under consideration. On February 19th it was decided that the London defences should be handed over to me, and on February 26th it was further decided that I should be responsible for the whole of the anti-aircraft land defences of the United Kingdom. Previous to this I had given considerable attention to the subject of anti-aircraft defence, and I submitted a scheme for consideration, which was approved, and has been carried out.

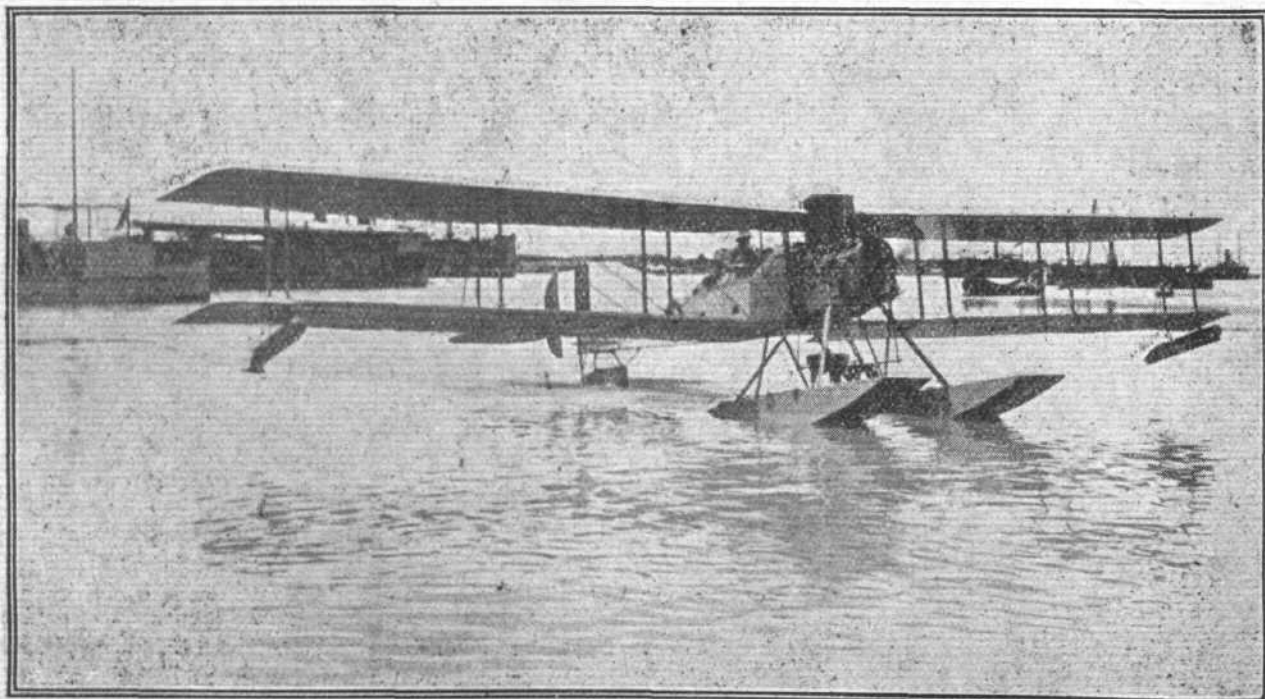
"During the winter there was little hostile activity in this direction, but since I assumed charge of these defences enemy airships and aeroplanes have invaded the country whenever conditions have admitted. The numbers of airships taking part in a raid have varied considerably. On April 3rd only one was engaged, whilst in the raid of September 2nd-3rd

not less than 12 ships are believed to have taken part.

"In all, 19 raids have been made by German airships and 17 attacks have been made by aeroplanes. The damage done has been comparatively small, and nothing of any military importance has been effected.

"Taken as a whole, the defensive measures have been successful. In very few cases have the enemy reached their objective. They have been turned, driven off, seriously damaged by gunfire, and attacked with great success by aeroplanes. Seven have been brought down, either as the result of gunfire or aeroplane attack, or of both combined.

"The work of the Royal Flying Corps and of the gun and light detachments, including the Royal Naval Anti-Aircraft Corps, has been arduous, and has shown consistent improvement; the guns and lights have been effectively handled, and the pilots of the Royal Flying Corps have shown both skill and daring. All are deserving of high praise. Close co-operation with the Navy has been maintained, and the Royal Naval Air Service, by their constant and arduous patrol work on the coast and overseas, have shared in successful attacks on the enemy."



WITH THE BRITISH FORCES IN MESOPOTAMIA.—A seaplane returning to the slipway at Bazra after trials.

(Official photograph issued by the Press Bureau.)

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

New Club House.

The New Club House at 3, Clifford Street, W., is now open to Members.

Luncheon and Dinner are served daily, and Bedrooms are available.

Suspension of Entrance Fees of New Service Members.

Until further notice, Service Members will be elected to the Royal Aero Club without Entrance Fee.

Subscriptions.

Members are reminded that the Subscription of £5 5s. for the year 1917 became due on the 1st January last. Bankers' Order Forms can be obtained on application to the Secretary.

Servants' Christmas Fund.

The Subscription List for this Fund is now open.

THE FLYING SERVICES FUND

administered by

THE ROYAL AERO CLUB.

The Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed. The Fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers, and men.

Forms of application for assistance can be obtained from the Royal Aero Club, 3, Clifford Street, New Bond Street, London, W.

Subscriptions.

	£	s.	d.
Total subscriptions received to Jan. 16th, 1917	11,113	3	2
Collected at the Westland Aircraft Works, Yeovil (Sixty-second contribution)	..	0	3
Staff and Workers of Gwynnes, Ltd. (Thirtieth contribution)	..	8	15

Total, January 23rd, 1917 11,122 1 11

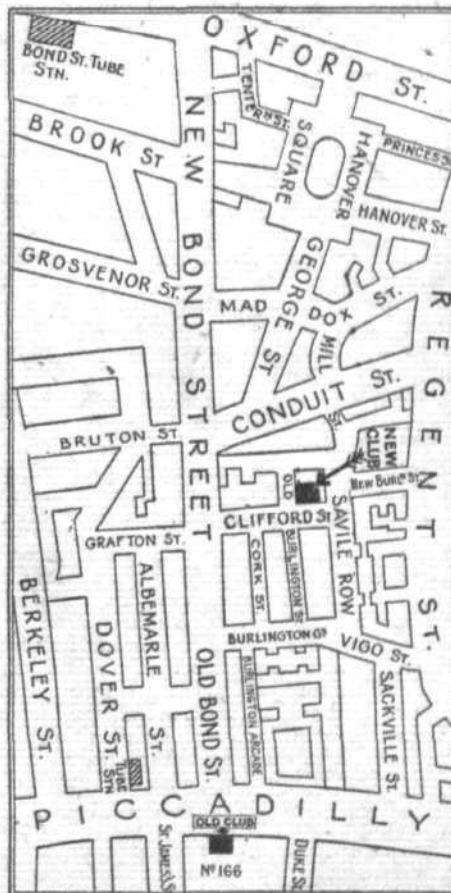
B. STEVENSON, Assistant Secretary.

3, Clifford Street, New Bond Street, W.



The Car.

No. 3, Clifford Street, New Bond Street, W. The new premises of the Royal Aero Club.



Plan showing position of New Club House, 3, Clifford Street, New Bond Street, W.

Fatal Accidents.

An inquest was held at Woolwich on January 20th on Lieut. A. Ravenscroft, R.F.C., who died on January 16th. The evidence showed that whilst flying the officer, who had had considerable experience of flying, attempted to alight in a field, but the aeroplane went too far, crashed into some trees, and overturned. Lieut. Ravenscroft's head struck a tree-stump, which fractured his skull. It was stated that

there appeared to be nothing wrong with the machine, and apparently Lieut. Ravenscroft made an error of judgment in landing. A verdict of "Accidental Death" was returned.

A verdict of "Accidental Death" was also returned at an inquest on January 20th on Air-Mechanic R. Stanley, who was killed while flying. Evidence was given that Stanley, who was an experienced pilot, rose well, but in turning at a low altitude failed to bank, with the result that the aeroplane nose-dived to earth.

HOW GERMAN PILOTS FIRE "THROUGH" THE PROPELLER.

THE idea of firing a machine gun between the blades of a propeller in motion, generally admitted to have originated with Mons. Garros, the famous French aviator, has by now become very extensively adopted by the aviators of all the belligerent nations. While the French method, by which the portion of the propeller blade that comes in line with the trajectory is armoured to protect it from damage, is generally known over here, the much more elaborate system said to be used on some of the German machines is, perhaps, not so widely known. Early in 1915 we recorded in "FLIGHT" that a German inventor had patented an arrangement by which firing of the machine gun was prevented at the instant when a propeller blade was in line with the gun. The general arrangement of this "fire interrupter," as we shall call it for want of a better name, is illustrated and described as follows by our contemporary, *Scientific American*:-

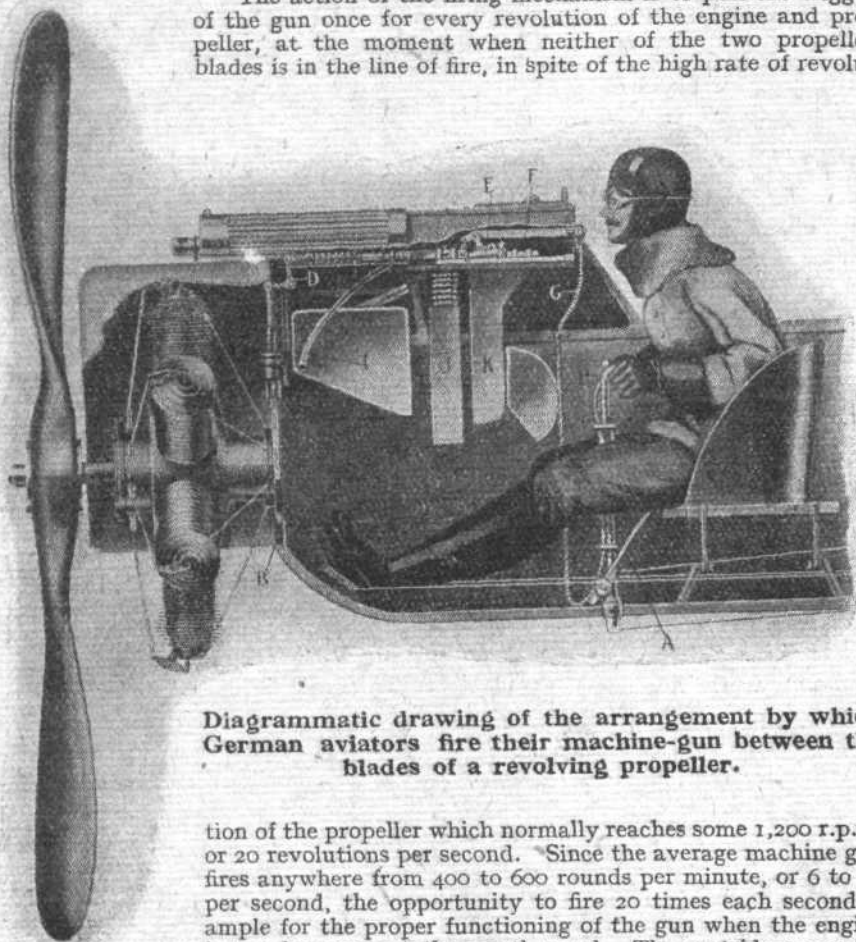
"The first move of the Fokker pilot after engaging with an enemy airman is to settle on a certain plane of flight and then lock the elevator control by means of lever A, so that he can then steer to right or left by the action of his feet on the rudder bar and maintain lateral balance by moving the control post with his knees; but he must continue the flight in the same plane until the elevator is again freed. This procedure permits the airman to use his hands, since they are no longer required on the handle bars.

"The machine gun of the Fokker is of the Maxim type, and is immovably affixed above the engine cowl and slightly to the right, so that its line of fire passes through the path of the revolving propeller in front. In sighting his gun the pilot, as previously stated, manoeuvres his aeroplane until the sights register on the target. This task calls for a high degree of skill, for both the firing medium and the target are mobile, while the steering of an aeroplane is accomplished by relatively slow movements of considerable amplitude.

"Instead of the machine gun being fired by pulling the trigger, as in usual practice, the trigger is operated by a cam and transmission mechanism under the control of the pilot. On the revolving shaft of the rotary engine is a disc carrying a slight bulge at one point whose relation is at right angles to that of either propeller blade. The disc is indicated at B, while upon it rests a small wheel, C, which receives the reciprocating movement brought about by the

use of the cam member. The reciprocating movement is transmitted by a system of levers and springs, D, finally terminating in the piece E, which is hinged as shown. Normally, when the gun is not firing, the piece E is raised so that the reciprocating movement ends with it; but at the moment the pilot is ready to fire the gun he presses a small lever, H, fixed in the centre of the steering bar control, which, by means of the Bowden wire G, causes the piece E to be brought down in line with, and to act upon, piece F. The latter acts directly upon the trigger of the gun.

"The action of the firing mechanism is to pull the trigger of the gun once for every revolution of the engine and propeller, at the moment when neither of the two propeller blades is in the line of fire, in spite of the high rate of revolu-



Diagrammatic drawing of the arrangement by which German aviators fire their machine-gun between the blades of a revolving propeller.

tion of the propeller which normally reaches some 1,200 r.p.m. or 20 revolutions per second. Since the average machine gun fires anywhere from 400 to 600 rounds per minute, or 6 to 10 per second, the opportunity to fire 20 times each second is ample for the proper functioning of the gun when the engine is turning over at the usual speed. The cartridges are fed into the gun from the belt magazine J, the empty shells are ejected through the tube I, which passes through the wall of the fuselage, while the empty belts are deposited in the container K."

Women for Aero-Engineering Work

THE Ministry of Munitions is extending its plans for the employment of women on engineering work. Classes for training in setting-up and skilled operating on various types of machines are being held in London, and the Ministry appeals to women of good education and physique, between 20 and 35 years of age, to undertake the training. The course will last from eight to nine weeks. Maintenance grants will be paid during this period, and those who become fully proficient for service in aero-engine or other munition works may expect a minimum wage of £2 per week. Candidates must be prepared to accept employment in any factory to which they may be sent on the completion of their training, and to work during the usual factory hours. Application, in writing, giving particulars as to age, educational qualifications, and previous mechanical experience (if any), should be made to the Ministry of Munitions (Training Department), 6, Whitehall Gardens.

British-Made Magnetos on Top.

THE perfection of the high-speed internal-combustion engine which began with the introduction of the motor car 21 years ago has remodelled our methods of traction and at the same time created a vast industry, with a large number of contributory trades more or less dependent on it.

Among the most important of these may be classed the manufacture of magnetos. But when war broke out there was only one British firm making magnetos, its output being under a hundred a week. Practically every magneto which went on to the motor vehicles, motor boats and aircraft of Great Britain came from enemy Germany or from America. Till August, 1914, we had been content to go abroad for nearly all our magnetos.

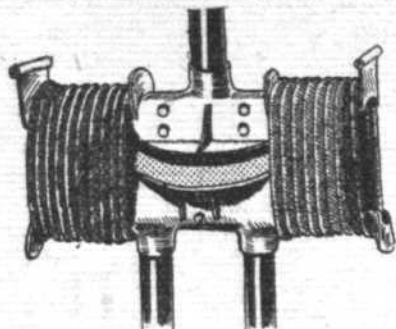
But in a few short months British manufacturers got steadily to work. Some of the best scientific brains in this country were enlisted. New and special steels and other materials were evolved. To-day there are some 12 or more British firms making magnetos.

Their entire outputs, so we now are officially informed, reaching a total to date of over 165,000 magnetos, have been made for war purposes, and are used on aeroplanes, sea-planes, airships, motor lorries, motor ambulances, motor cycles, "Tanks," big gun tractors, motor boats, wireless sets, searchlight sets, lighting sets, &c., &c. In fact, it may be said that the war is being conducted on British-made magnetos.

After the war the resources of the British magneto manufacturers will be at the disposal of the British public. There will be no need to buy enemy or other foreign magnetos.

ANSWERS TO CORRESPONDENTS

[As a number of letters reach us signed with initials only, some of which do not give a complete address, we would point out that such communications cannot be dealt with in our columns. Full name and address, which will not be published, must always be given.—Ed.]



J. W. T. (Eastbourne).

"Those oblong shaped blocks (or tanks) just above the landing wheels of the Avro biplane" are aluminium covers enclosing the rubber shock absorbers. The action of the latter will be clear from the accompanying sketch.

L. J. P. (R.N.A.S.).

An aerofoil is defined in the report of the Technical Terms Committee of the Aeronautical Society of Great Britain as "A structure, analogous to the wing or tail of a bird, designed to obtain a reaction from the air approximately at right angles to the direction of its motion." In other words, an aerofoil in connection with the aeroplane is a wing—the whole wing, and not, as you appear to think, any particular portion of it. The "creep error" in an altimeter is a slight inaccuracy in registering height, growing worse with altitude and being more pronounced in descending than in ascending. It is probably mainly due to changes in temperature with altitude. An aeroplane starting from an aerodrome situated 200 ft. above sea level and having its altimeter registering zero when starting off, will, when the altimeter registers 1,000 ft., be at a height of $1,000 + 200 = 1,200$ ft. above sea level, disregarding "creep."

W. D. K. (Sanderstead).

A non-rigid airship is one in which the envelope has no internal girder work, the shape being maintained by the pressure inside, and the car supported by ropes or cables from the envelope. The little Parseval airships were of this type. In a semi-rigid airship the envelope is, as in the non-rigid, without internal girders, but a girder or keel runs the whole or nearly the whole length of the envelope, and the car, instead of being supported direct from the envelope, is supported from this keel. Examples of the semi-rigid type are the German "M" type, designed by Major Gross, the French Lebaudy, and the Italian Forlanini. In the rigid type an internal framework stiffens the envelope, and the cars may either be contained in the keel or they may be slung underneath the envelope. The best known rigid airships are the German Zeppelins and Schütte-Lanz's.

C. F. P. T. (Bridgwater).

The average speed of a modern propeller is about 1,200 r.p.m. When engines running at greater speeds are employed a reduction gearing is generally incorporated, in which case the propeller speed may vary from 800 r.p.m. to 1,200 r.p.m. The weight of the 100 h.p. Gnome monosoupape (we take it that is the one you mean) is about 320 lbs.

T. N. McE. (Cricklewood).

The world's duration record—for pilot only—is held by the German aviator Boehm, whose time was 24 hours 12 minutes. In an aeroplane the thrust, head resistance and lift should all pass through the centre of gravity, and in modern machines they generally do so very nearly. If the centre of thrust is below the centre of resistance, as is the case in a good many machines, the centre of lift should be slightly to the rear of the centre of gravity, so that the weight-lift couple is equal and opposite to the thrust-resistance couple. These couples should, however, never be allowed to be very great. We have a very limited number of "FLIGHT" for which you inquire. The price is 1s. 6d. per copy.

"B.E.F." (France).

So far as we are aware, the centre of gravity of the Nieuport scout lies some little distance ahead of the leading edge

of the lower plane. That this must be so will be clear from a brief consideration of the general arrangement of the machine. Since the top plane is much the larger of the two, it must necessarily carry a greater proportion of the load than does the small lower plane. Assuming the centre of pressure to lie about one-third of the chord from the leading edge of the planes, the resultant centre of pressure of the two planes must lie closer to the centre of pressure of the top plane by an amount proportional to the share of the load carried by that plane. If the machine is to be reasonably stable the centre of gravity cannot be very far removed from this resultant centre of pressure, and will therefore at all events lie ahead of the spar of the lower plane. When, therefore, the machine is nose-heavy, balance is obviously restored by decreasing the angle, and consequently the lift, of the plane whose lift acts to the rear of the centre of gravity—namely, the lower plane.

C. E. B. (Brighton).

"The scarcity of monoplanes" is simply due to the fact that it has been found possible to design biplanes to give more effective results than monoplanes.

L. N. (Chulmleigh).

A flying officer can live on his pay. The necessary form can be obtained from Adastral House. A knowledge of motor driving and telegraphy would certainly be of great assistance.

C. E. D. (Bloxwich).

1. If you turn up page 984 in "FLIGHT," of November 9th, last, you will find the rates of pay fully set out. 2. Yes. 3. Four years or for the duration of the war.

V. A. (Nuneaton).

It is not necessary to be a mechanical engineer to join the R.F.C. or R.N.A.S. The lowest grading is third-class mechanic.

A. D. (Newbury).

He should join the R.F.C. Cadet Corps as soon as he is old enough. Full particulars can be obtained from Adastral House, E.C. If accepted, he would be trained at one of the military schools.

L. S. G. (Cricklewood).

Write to any of the flying schools advertising in "FLIGHT," stating what you are prepared to do. Some might be willing to make an arrangement. We regret we cannot give the other information you ask for.

J. A. A. (London, W.).

Civilian instructors are employed by the schools who are training Government pupils. The pay depends upon the ability and experience of the instructor.

D. K. G. (Hornchurch).

You must obtain the approval of your C.O., who would then recommend you for a commission. We are afraid the injury to your foot would prevent you getting through.

A. M. A. F. (Worthing).

The minimum age for the R.F.C. Cadet Corps is 18.

F. D. (Bradford).

Your age would probably bar you from obtaining a commission as flying officer or observer. Apply to your C.O. for permission, and then fill in the necessary form, which you can get from the Directorate of Military Aeronautics, Adastral House, E.C., and your C.O. will forward it with his recommendation, through the official channels.

G. P. (Norwood).

If you are old enough, you should apply for a transfer to the R.F.C. Cadet Corps. You would then be sent to one of the R.F.C. Schools for training in flying.

A. E. B. (Colchester).

1. You are more likely to get into the R.N.A.S. than the R.F.C., unless you can enter the R.F.C. Cadet Corps. Apply to Adastral House for particulars. Both services train their own pilots. There is no need to attest if you apply for a commission. Height is not necessarily a disqualification.

W. J. (Ilford).

If you are accepted for a commission in either the R.N.A.S. or the R.F.C., you would be taught to fly at a Government school.

Armchair Reflections

by the "Dreamer"

WITHOUT a doubt we live at the pleasure of others. In the mornings I travel to the office, in the evenings I travel back again. I am allowed to journey by a railway that is virtually under martial law. I pay

the fare that it has been decided by law, or by-law that I shall pay. Should it be decided to remove all the trains one morning I may stay at home, or walk, as I think best. We have no voice in matters these days.

Everything that we possess must go to the Government if necessary. We give of our men and our money. Of the latter, we have been told that if we do not give in sufficient magnitude, it will be taken. It might well happen that a shortage of leather would cause me to come to the

office without boots. Leather is material of war, and must be had. The war has altered many things, and aviation has played its part in not a few.

My friend Peter is an enthusiastic amateur photographer. Time was, in the days of the old wooden dustbin, when Peter was content with a small film camera with which to take pictures of this awful contraption from every conceivable point of view. Not that he particularly wanted to include it in his pictures; it would insist on being there. He really did his best to disguise it by various hangings of carpets and curtains, assisting it in masquerading in sheep's clothing by the aid of the family geraniums and the castor-oil plant off the first landing. But that dustbin was ever a dustbin and never a rockery, or a rustic fence, or a distant view of the Alps, in spite of brown paper and virgin cork. But time proceeded as time has a habit of doing, and my friend progressed as artists should, until the small camera was of no further use to render a faithful record of his artistic brain-waves, and other cameras and lenses took its place.

The last time I saw Peter's outfit he had instruments worth a good deal more than his household furniture; the last time I saw Peter—which was last evening—he was in sore distress.

For from the place where such things issue, comes an order that all persons owning or having control of lenses over 8 ins. in focal length must make a return of them to Government, which may be read to mean, hand them over. And the aeroplane is directly

responsible for this, and the fact that Peter will have to hand out for a more useful purpose those cherished pieces of glass and metal.

In altering many things, as stated above, the war has also found out many of our weak spots. In the early days of the war, when photography from aeroplanes and airships became a necessary and valuable part of the duties of the Flying Services, there were not enough lenses on sale in this country to go round, and the Government advertised their willingness to purchase at makers' list prices second-hand instruments of the kind desired. And now the same thing has happened with those of the long-focus variety, only this time it is a demand and not a wish.

It is hardly worth one's while wondering why the numerous lens makers in this country cannot supply the Government with the instruments they require, for it is exactly the same story as has applied to so many other of our so-called home industries.

For while our best makers advertised that their lenses were every bit as good as those of foreign manufacture—and I will admit that they were—they yet relied on getting the glass required from "over there," and so, when the supply dried up as a natural consequence of hostilities, our manufacturers followed suit to a very great extent. And now Peter's instruments, together with those of all other holders, will have to travel along to 177, Piccadilly, and there are but seven days in which to comply with the order, so hurry along.

AN OLD SOLDIER



JUST A COUPLE OF LITTLE PICTURES.

One day last week I had occasion to board a 'bus, and noticed that the conductress had decorated herself up to the highest degree. Fastened to her jacket she had the following articles, all on one side: One of those fluffy little golliwogs, over which was a small paper Union Jack. Beneath these was the badge of a Scotch regiment, and under it a magnificent dark red rose of the real kind. Beneath these again was a thistle worked in silk. I passed the well-known joke of "All dressed up and nowhere to go," but she only smiled and buried her nose in the flower. Presently we stopped to pick up a gentleman who was evidently a "regular," for the following conversation ensued:—

"Unusual to pick you up at this time of day," remarked the fair fare gatherer.

"Yes," he replied. "What's the matter to-day? Got the boy home from the Front?"

"No. But he's coming home next week on two weeks' leave, and he's a D.S.M. What do you think of that?"

"Then I suppose I shan't see you on the day he arrives?"

"You won't see me for the whole fortnight. I'm



going to take him out and make him enjoy himself. What do you think I am doing this for?"

THE OTHER PICTURE.

Strangely it happened when I alighted from the very "bus on which the first picture was opened out to me. It was outside the Garrick Theatre. There was an old, old man—he must have been at least 80 years of age—and he was a bootlace seller. You may guess that his clothing was more rags than cloth, and that his boots were boots only by courtesy. He had laid his stock-in-trade on a ledge, and was busy emptying his pockets of all his belongings. There were bits of paper, cigar and cigarette ends, bits of string and all

that kind of thing. Quite an ordinary everyday picture; but what called my attention to him was three ribbons across his breast, and the fact that a soldier of to-day was watching the proceedings unknown to the other.

"His world," I thought. "Everything he possesses in this life is probably that little heap of rubbish."

The soldier moved forward and addressed him. "Hello, dad," he greeted him. "Having a clear out? What's your ribbons for?" "Oh, just a few little scraps, Laddie, just a few little scraps," he replied, "scraps with them I can take my hat off to now, not the Hun sort you got to deal with."



AVIATION has just scored another triumph in the decision of the French Academy of Sports to award its annual prize of 10,000 francs for 1916 to Lieut. Guynemer, Chevalier of the Legion of Honour, holder of the Medaille Militaire, Croix de Guerre, and the subject of a very large number of citations in the *Gazette*. The fact that Lieut. Guynemer has brought down 25 enemy aviators is, in the view of the Academy, due to his tactical cleverness and admirable courage. This prize, which was founded several years ago by that generous supporter of aviation, M. Deutsch de la Meurthe, to be given for the most outstanding performance of the year, has several times been awarded for air work. It may be recalled by readers of "FLIGHT" that it was given to "Beaumont"—otherwise Lieut. Conneau—for his various long flights on a Blériot in 1911, while in 1912 it fell to Garros for twice beating the height record, winning the Ae. C. F. Grand Prix, and his flight from Tunis to Rome.

THERE are quite a few men who have already served their country through the Naval side of our forces, and had to give in to that master of all mankind—ill-health. To most of these the decision of the Admiralty to authorise officers of the Naval services, who have been invalided out for this reason, to retain their rank in private life, will come as a pleasant reward for their past work. That the new order does not carry with it the right to wear uniform, and that the privilege only applies to officers whose disabilities are controlled in and directly caused by the Service, will hardly be quarrelled with.

THE order is the more welcome as it is retrospective to the outbreak of war, and applies not only to R.N. officers but to the R.N.A.S., R.N.R., and R.N.V.R. It is necessary, however, where an officer has already been invalided out under these circumstances for application to be made to the Secretary of the Admiralty in the event of the right to use the old rank being claimed.

THERE have been some pretty patriotic families this side of the ghating lines, in giving sons to the cause. Eleven boys of one father sounds, however, like being well in the running for record. Perhaps, though, after all, as the story comes from Germany via Amsterdam, this one short of a dozen done to death in one of the Hun Zepp. piratical raids story has had to be brought into being through anything less not sufficing to bring in sufficient marks—having regard to the collapse of the Hun Exchange—to make up the equivalent to Pa—or is par? Anyway, here is the story as told by the Dutch special correspondent of the *Daily Chronicle* :—

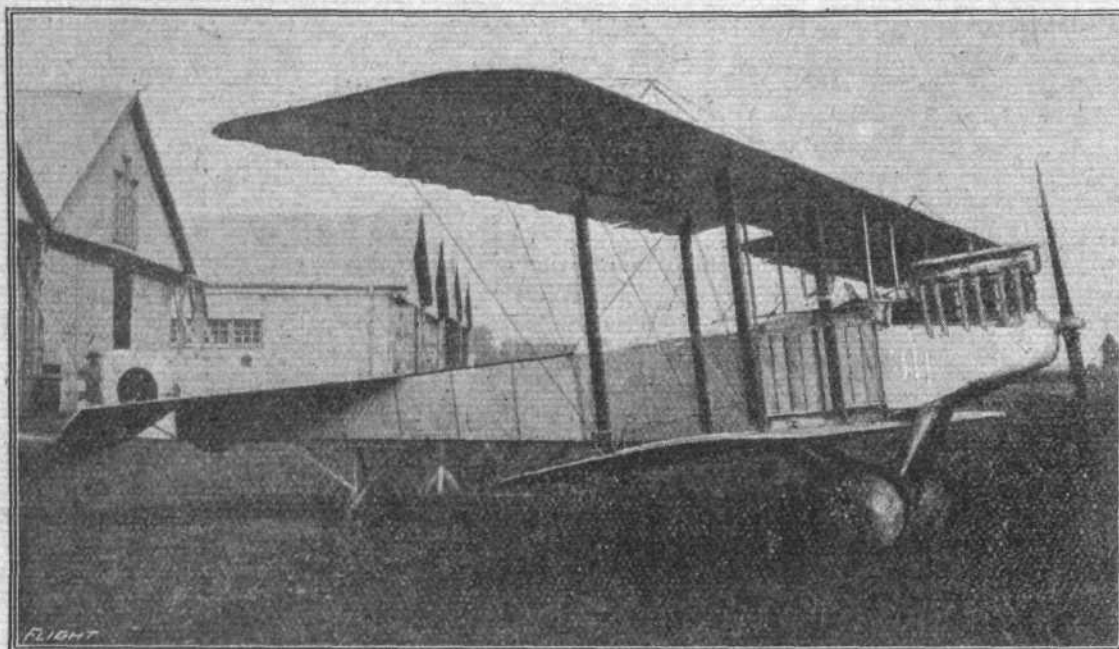
"In one of the most recent disasters to Zeppelins which visited England eleven brothers were burnt to death.

"An aged man recently here from Germany told how he brought up a family of eleven sons, every one of whom entered the air service. The eleven young men formed part of the crew of one of the destroyed Zeppelins, and when this fell in flames in England they all perished.

"My only consolation," said the father, "is that they died for the Fatherland."



The 100 h.p. Curtiss triplane, on which Miss Ruth Law proposes to make an attempt on an American coast to coast flight, following on her recent record, when she flew from Chicago to New York. Her idea is to start from San Francisco for New York in the spring.



Aviation in Japan.—Side view of a Japanese military tractor biplane.

QUITE a picturesque touch was added to a wedding last week at St. James's Church, Sussex Gardens, when Capt. W. B. Bryans, Norfolk Regiment, attached R.F.C., was married to Miss Mildred Ramsbotham, of Exmouth. A bevy of munition girl workers foregathered at the church in their blue overalls and caps and formed themselves into a guard of honour for the happy couple to pass between, the little compliment being appropriate by reason of the bride having worked for some months with her supporters at a munition factory Acton way. This war is truly making for a new form of Socialism.

THERE appears to be a general inclination for joining up with the R.F.C. direct instead of by transfer. There is plenty of room at present at least for both methods to work themselves to the same successful end.

So poor Cody's old machine is to be responsible after all for helping along some of the country's embryo flyers. It has been taken over by the 1st Cadet Battalion, Hampshire Regiment, in connection with a Flight Company, which the Colonel, the Hon. Sir Harry Crichton, is forming for the regiment. By its use those youngsters with an airy tendency will acquire the elementary work attached to flying.

A VARNISHER of aeroplane propellers imparted information to the Shoreditch Tribunal the other day of the highly skilled character of his particular work. "The propeller is on ball bearings," he said, "and the balancing is a most

delicate matter, as even a fly on it would put it out of balance. When we wish to test how much more varnish can be put on a spot we test it first with little scraps of paper."

SOME fly, that!

By the much-lamented death last week of the Duke of Atholl, the Marquis of Tullibardine, the Chairman of the Royal Aero Club, succeeds to the title.

THE Marquis was also attached to the Aeronautical Society of Great Britain as a Vice-President.

It is to be hoped the onerous duties of the succession will not interfere with the new Duke's very helpful and practical work in the aeronautical world.

A propos the vast importance of the "Aeronautical Institute of Great Britain," some curious information was given by Mr. L. Blin-Desbleds, whose name appears so prominently in connection with all its doings, regarding the carrying on of this "Institute" with its wonderful list of patrons, &c.

LAST week at the Westminster County Court the question before Judge Woodfall was the payment by Mr. Desbleds of an unsatisfied judgment for £11 in regard to the cost of a propeller from the Integral Propeller Co., Ltd., supplied away back before the war. From amongst the statements of Mr. Desbleds, who was resisting an application for a court order to pay up by instalments, it would appear that this "Institute"

Aviation in Japan.—Capt. Tokugawa's training machine at the Tokorozawa Aerodrome.



Aviation in
Japan.—A 100
h.p. Nieuport
at the Tokoro-
zawa Aero-
drome.



is not a partnership, it is not a limited company, that Mr. Desbleds does not know if he is responsible for it, that there is a tenancy agreement without guarantee between the L.C.C. and the "Institute" at £250 per annum, to which he is not a party; that the workshop at the "Institute" a few doors from where he lives is nothing to do with him, that the majority of his time is devoted to the Institute. Further, that he gives his services free to the Society of Engineers, acts as Director and Hon. Secretary of the "Institute" and as editor of the "Institute's" journal upon the same rate of remuneration, all because he has been so much black-guarded in the press that he has to establish his position. Which sounds quite illuminating; but it is difficult nevertheless, to reconcile all these facts with the wonderful literature which periodically emanates from the offices of the "Institute" setting forth what Mr. Desbleds and his Institute are accomplishing in putting the Art, Science and Industry of aviation upon its feet.

THERE appear to be others who in this year of our Lord one thousand nine hundred and seventeen have suddenly had brain-waves prompting them to take the aeronautical world under their wing. It's wonderful, though, how well some industries manage to get along through all their early troubles without the help of all these wonderful healers, who are generally waiting to try and grab the fruit the other fellow has carefully nurtured and brought to maturity.

TEN YEARS AGO.

Excerpts from the "Auto." ("FLIGHT's" precursor and sister journal) of January, 1907. "FLIGHT" was founded in 1908.

THE MILITARY SIDE.

It is good news to hear that an officer employed by the Government in connection with the Balloon Section of the Army at North Camp, Aldershot, has committed himself to the following statement:—

"If a foreign Power were to launch an aerial fleet against

Great Britain to-morrow, Great Britain would be able to meet it in mid-air."

But so it is reported. We are also informed by the enterprising daily paper responsible for the above pronouncement, that nearly 500 men are being trained for service in Britain's aerial fleet. One can only commend the extreme secrecy with which the aeronautical section of the British Army has carried out its tests and experiments, if the statement referred to above is indeed in accordance with facts.

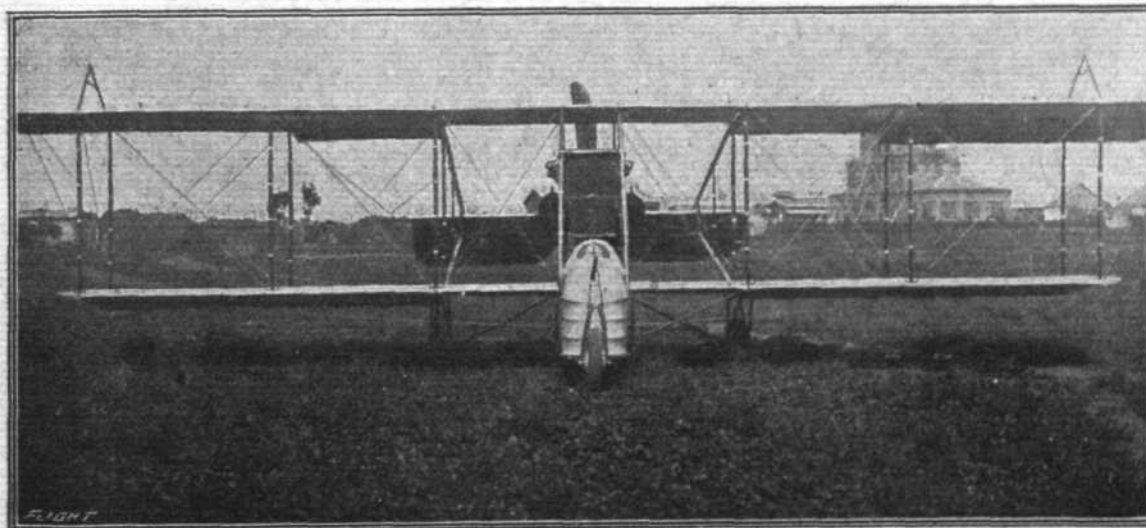
COLONEL CAPPER ON THE SITUATION.

A *propos* of the same subject, Colonel Capper, the head of the Balloon Section at Aldershot, contributes some very sensible observations. He observes that "an aerial section of our Army is not merely a hobby of ambitious inventors, but is absolutely a necessity, if we are to continue to hold the same position in the world which we have now." He adds that it is necessary to awaken public interest in the question of aerial navigation, all great revolutions in the past in naval and military warfare having, according to the Colonel, been due principally to private enterprise. That may or may not be the case, but one cannot help the belief that private enterprise would be stimulated if private individuals beheld the Government doing its level best in the same direction. The situation is a serious one. For it does not require prolonged reflection to enable us to reach the conclusion that the moment any foreign power really builds an effective aerial battle fleet, from that instant, as far as military strategy is concerned, Great Britain will become a part of the Continent.

Colonel Capper is very sanguine as regards the future of the aeroplane. He anticipates a speed of 200 miles an hour or more, and that, in the future, "airships will be so plentiful that there will be legislation for them in the same way that we now have it for motor cars and ordinary traffic."

A BELGIAN AIRSHIP.

M. Victor Hoppe, of Brussels, is the latest recruit to the ranks of the designers of navigable balloons, whose airship is being built at Jumet, and will be fitted with a 40 h.p. motor.



Aviation in
Japan.—A
Japanese mili-
tary machine of
the Curtiss
type.

Personals

Casualties.

Second Lieutenant GEOFFREY RICHARD BOLITHO, Devon Regiment, attached R.F.C., fifth and youngest son of the late Captain Edward Bolitho, R.N., and of Mrs. Edward Bolitho, Rockbeare House, Exeter, and grandson of the late Mr. T. S. Bolitho, of Trengwainton, Cornwall, who had been missing since October 25th, is now reported killed. He was educated at L'Ecole de l'Île de France, at Wellington College, and at Trinity College, Cambridge. On the outbreak of war, having just left Cambridge, he was given a commission in the Devonshire Regiment. He went out to France in March, 1915, and last May he transferred into the Royal Flying Corps. He became an observer, and was wounded in August. During a bombing expedition over the German lines in October his machine was brought down by the enemy. Mr. Bolitho, who was the youngest of ten children, was born in 1893. He has three brothers now serving at the Front and one brother in the Navy.

Second Lieutenant GEORGE ALLAN EXLEY, King's Own (Yorkshire Light Infantry), attached R.F.C., killed, was a son of Mr. and Mrs. J. Exley, of Fair Royd, Burley-in-Wharfedale, and was 23 years of age. At the outbreak of war he enlisted in the Royal Engineers, and was in training as a despatch rider at York. He subsequently transferred to the King's Own Yorkshire Light Infantry, and got a commission. He joined the Royal Flying Corps about twelve months ago.

Second Lieutenant RAYMOND HOPPER, R.F.C., reported killed, was the son of Mrs. Hopper, 114, Coltman Street, Hull, and was educated in the ancient Grammar School of that city. Before joining the Royal Flying Corps he served six months in France with the Public Schools Battalion of the Royal Fusiliers.

Second Lieutenant ARNOLD CLEMENT PANTING, Royal Munster Fusiliers, third son of Mr. and Mrs. J. Harwood Panting, of Norbury (late of Brixton Hill), was killed on January 13th while returning from an air reconnaissance. He was educated at Alleyn's College, Dulwich, and on leaving there joined the editorial staff of the Amalgamated Press. When war broke out he had been editor for some three years of the *Boys' Friend*. He joined the O.T.C., and obtained a commission in the Queen's. He was drafted to Egypt, and attached to the Royal Munster Fusiliers. He afterwards transferred to the Royal Flying Corps, and was killed whilst acting as observer, his machine falling (according to official report) 1,000 ft. Before the war Lieutenant Panting took keen interest in the Boys' Brigade, and won the Challenge Shield of his company for gymnastics three years in succession.

Captain LESLIE PORTER, R.F.C., who had been reported missing since October 24th last, it is now announced, died on that day as a prisoner of war in the hands of the Germans. A son of Captain Porter, Royal Army Medical Corps, he was a remarkably able engineer, and was one of the first in Ulster to recognise the importance of the motor industry, founding under his own name a business which quickly developed. He took part in many of the notable motor races at home and abroad, and had a marvellous escape from death in the Paris and Madrid race, when his car was wrecked and his colleague killed. Captain Porter joined the Royal Flying Corps fifteen months ago, and last summer married Miss Brown, daughter of a well-known Belfast gentleman. Last August, Captain Porter flew from England to Belfast, and gave several exhibition flights over the city. The news of Captain Porter's fate came to his family through the United States Ambassador at Berlin, who took the matter up at the suggestion of the Crown Princess of Sweden.

Flight Sub-Lieutenant R. K. J. VALLINGS, R.N., whose death is officially announced, was killed on January 13th,

aged 23. He was the elder surviving son of the Rev. J. F. Vallings, vicar of Sopley.

Second Lieutenant THOMAS HUGH FRENCH, who was killed in Yorkshire while flying in a snowstorm on January 13th, was the fourth son of Mr. and Mrs. E. D. French, of Ulting, Essex. Born in 1895, he was educated at the King's School, Canterbury, where he was a member of the O.T.C., and held a record for cricket. On the outbreak of the war he joined the Public Schools and University Corps, and while on active service with it was highly commended for his shooting, being offered special leave for a very clever sniping feat. In March last he got his commission, and joined the R.F.C. in August last. Second Lieutenant French made quick progress, and was regarded by his commanding officer as a very competent and careful pilot.

Lieutenant ALAN PADDOCK RAVENSCROFT, R.F.A., attached R.F.C., who has died in his 25th year, at the Royal Herbert Hospital, Woolwich, as the result of an accident while flying, was the elder son of Mr. and Mrs. F. A. Ravenscroft, late of Wallasey, Cheshire, and was educated at Elleray Park, Wallasey, and Malvern. At the outbreak of war he was farming in the Argentine. He came home and received a commission in the R.F.A. He was at Suvla Bay until the evacuation, and returned to Egypt with his regiment, and came to England last August. He transferred later to the R.F.C.

Married and to be Married.

Second Lieutenant TREVOR DAVIDSON, Essex Regiment, attached R.F.C., only son of Mr. THOMAS BISHOP SOUTHGATE, of Rio de Janeiro, was on January 18th, at St. Andrew's Church, Westminster, married to VERA MURDOCH, elder daughter of Major W. H. COYSH, R.E., of Rose Bank, Dovercourt.

A wedding is announced to take place shortly between IRIS, elder daughter of Commander Sir TREVOR DAWSON, R.N., and Lady DAWSON, of Green Street, Mayfair, and Captain (Temporary Lieut.-Colonel) JOHN MICKLEM, D.S.O., M.C., Rifle Brigade, son of Mr. and Mrs. Leonard Micklem, of Abbots Mead, Elstree.

A marriage has been arranged between Lieutenant R. DUNCAN FOSTER, Royal Garrison Artillery, attached R.F.C., and HILDA, only daughter of B. FAIRFAX-BROWN, of The Mount, Baschurch, near Shrewsbury.

Captain HUBERT C. L. HOLDEN, R.F.A., son of Colonel Sir Capel Holden, K.C.B., F.R.S., late R.A., and Lady Holden, was on January 20th married at Shobrooke Church, Devon, to MARGARET, eldest daughter of the late Mr. J. W. KNIGHT-BRUCE, and niece of Miss Cleave, of Newcombes, Devon.

The marriage of Squadron-Commander DOUGLAS OLIVER, D.S.O., R.N., and Miss SHEILA GRANT-SUTTIE took place very quietly on January 15th at St. Andrew's, Ashley Place, S.W.

The marriage of Miss MILDRED ISOBEL ELEANOR RAMSBOTHAM, youngest daughter of the late Lieut. T. Ramsbotham, R.N., and Mrs. Ramsbotham, of Enniskerry, Exmouth, and Captain WILLIAM BUCHANAN BRYANS, 3rd Norfolks, attached R.F.C., youngest son of Mr. and Mrs. Arthur Bryans, of Talbot Square, and Holmwood Cottage, took place at St. James's Church, Sussex Gardens, last Saturday. Captain J. L. Jackson, M.C., R.F.C., was best man.

An engagement is announced between Flight-Commander HAROLD E. MOSTYN WATKINS, Royal Navy, son of the late Rev. Charles and Mrs. Watkins, and DOROTHY, younger daughter of the late WILLIAM COOKE-YARBOROUGH and Mrs. COOKE-YARBOROUGH, of 126, Sinclair Road, W.

Deutsch Prize for Guynemer.

It is announced from Paris that the Académie des Sports has awarded to Lieut. Guynemer its annual Grand Prize of £400, established by M. Deutsch de la Meurthe some years ago.

Lieut. Guynemer, who has brought down 25 enemy machines, has won the Legion of Honour, the French Military Medal, and the War Cross.

Aeroplanes at Japanese Military Manœuvres.

A FEATURE of the Japanese military manœuvres held at Kynshu, in the presence of the Emperor, during the first half of November, was the participation of 16 aeroplanes, eight being attached to the "invading" force and eight to the "defenders." A good deal of night flying was carried out. Four of the machines which took part flew from Tokorozawa to Fukuoka, a distance of about 700 miles.

The British Air Service

"PER ARDUA AD ASTRA"

UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, it is not repeated in this column.

Royal Naval Air Service.

Admiralty, January 18th.

Capt. C. L. Lambe graded as Wing Capt., to date Dec. 31st.
Temp. Flight Sub-Lieut. S. H. F. Mills granted temp. commission as Lieut., R.N.V.R., with seniority Jan. 17th; and F. A. Yeo, with seniority May 30th.

A.M.I.—J. Meadows promoted to the rank of Warrant Officer, 2nd grade, with seniority Jan. 16th.

Admiralty, January 20th.

Flight-Lieut. R. M. Everett appointed Acting Flight Com., to date Dec. 14th.

Flight Sub-Lieut. S. J. Wooley appointed Acting Flight-Lieut., to date Dec. 3rd.

The following Chief Petty Officers and Petty Officers promoted to Warrant Officers, 2nd grade, all with seniority Jan. 18th: C. Snow, C. H. Hayman, R. J. E. Haynes, T. F. Mathewson, E. E. Crook, J. V. Reeve, C. Brooks, J. W. Hoskings, H. Nelson, A. H. P. Berry, W. Wheatley, J. W. Hutchins, E. Simpson, A. A. Barnes, J. D. Shotton, H. E. Maskew, K. W. Rainbow, C. W. Pidcock, R. Gowing, H. A. Ward, G. V. Grundy, G. S. Wybrow, J. E. Catt, L. Burgoine, B. Williams, A. B. Redstone, J. A. Owen, W. R. Heywood, G. N. Coward, C. Attrill, B. Scovell, H. J. Usher, W. Gill, G. A. Stroud, H. G. Cook, A. Matthews, R. L. Hartley and A.M.I. C. Urmson.

Admiralty, January 22nd.

Wing Commanders (acting Wing Captains).—R. M. Groves, D.S.O., and W. Elder, promoted to Wing Capt., both with seniority Dec. 31st.

Flight-Lt. H. K. Thorold, D.S.C., reappointed as Actg. Flight Com., to date Dec. 29th.

J. W. Griggs, granted a temp. commission as Lieut., R.N.V.R., and appointed to "President," additional, for duty with R.N.A.S., to date Jan. 20th.

The undermentioned Temp. Flight Sub-Lieuts. reappointed as Temp. Actg. Flight Lieuts., all to date Dec. 29th: L. M. Bailey, E. E. Maitland-Heriot, A. G. B. Ellis, and W. H. Strettel-Miller.

Royal Flying Corps (Military Wing).

London Gazette, January 16th.

The under-mentioned to be Temp. 2nd Lieuts. (on prob.), for duty with R.F.C.: Pioneer E. W. Swann, from R.E.; Dec. 19th. Corpl. E. C. Davies, from R.E.; Dec. 23rd.

Flying Officer.—Temp. 2nd Lieut. E. L. Hyde, Gen. List; Dec. 14th.

Memorandum.—Temp 2nd Lieut. L. A. Berry relinquishes his commission on appointment to Naval Air Dept., Sept. 11th.

Supplementary to Regular Corps.—2nd Lieut. F. A. Crispin is placed on the Retired List on account of ill-health; Jan. 17th, 1917. The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: J. Ferguson, H. F. Wilkinson, S. G. Elliott-Smith, C. W. Olliver, A. L. C. Hartland-Rowe, F. Stoner and J. E. Arnott.

London Gazette Supplement, January 17th.

Memorandum.—R. H. Peto, late 2nd Lieut., 10th Hrs., to be Temp. Lieut. for duty with R.F.C.; Jan. 18th, 1917, with seniority from Sept. 1st. Ordinary Seaman C. J. Miln, from R.N.V.R., to be Temp. 2nd Lieut. (on prob.) for duty with R.F.C.; Jan. 1st, 1917.

London Gazette Supplement, January 18th.

Flight-Commander.—The appointment of 2nd Lieut. (Temp. Capt.) A. S. C. MacLaren, M.C., K.O. Sco. Bord., S.R., notified in the Gazette of Nov. 8th, is antedated to Oct. 1st.

Flying Officer (Observer).—2nd Lieut. E. R. Wilkinson, E. Ian. Field Co., R.E. (T.F.), is as now described, and not as in the Gazette of Dec. 18th.

Memorandum.—Acting Sergt.-Major T. J. Hudson, from R.F.C., to be 2nd Lieut. for duty with R.F.C.; Jan. 19th.

London Gazette, January 19th.

A.G. and Q.M.G. Staff.

D.A.Q.M.G.—Capt. E. R. L. Corballis, R. Dub. Fus., from an Equipment Officer, 1st Cl., R.F.C., vice Capt. (Temp. Major) A. Christie, R.A.; Dec. 31st.

Attached to Headquarter Units.

Brig.-Gen., R.A.—Bt.-Col. (Temp. Brig.-Gen.) E. B. Ashmore, C.M.G., M.V.O., R.A., and to retain his temp. rank whilst so employed; Dec. 20th.

Brig.-Comdrs. and to be Temp. Brig.-Gens. whilst so employed.—Major J. H. W. Becke, D.S.O., Notts and Derby R., from Wing Comdr. and Temp. Lieut.-Col., R.F.C., vice Bt.-Col. (Temp. Brig.-Gen.) E. B. Ashmore, C.M.G., M.V.O., R.A.; Dec. 20th.

Flying Officers.—Dec. 24th: 2nd Lieut. J. E. Arnott, S.R.; Temp. 2nd Lieut. (on prob.) G. Wood, Gen. List; Temp. 2nd Lieut. R. W. G. Morrison, attd. E. Surr. R.; Temp. 2nd Lieut. C. A. F. Rogers, Gen. List. Dec. 26th: Temp. Lieut. A. P. Ravenscroft, R.A., and to be transfd. to Gen. List; Lieut. K. MacKenzie, Sea. Highrs., S.R., from a Flying Officer (Ob.), with seniority from July 1st; 2nd Lieut. O. C. Bryson, Dorset Yeo. (T.F.); Temp. 2nd Lieut. (on prob.) W. B. Cooke, attd. E. Surr. R.; 2nd Lieut. F. Stoner, S.R.; Temp. 2nd Lieut. H. H. Maddocks, Gen. List; Lieut. W. M. Fatt, Canadian Gen. List. Dec. 27th: Temp. Lieut. L. J. Gulliver-Cradwick, Essex R.; 2nd Lieut. T. Barclay, High. L.I. (T.F.); Temp. Lieut. T. G. Poland, attd. E. Surr. R.; 2nd Lieut. R. M. Chaworth-Musters, Leic. R., and to be sec'd.; 2nd Lieut. A. L. C. Hartland-Rowe, S.R.; Temp. 2nd Lieut. S. E. Dreschfeld, Gen. List. Dec. 29th: Capt. J. C. H. Storer, Canadian A.S.C.; Lieut. M. H. Coote, R.A., and to be sec'd. Dec. 30th: Temp. 2nd Lieut. G. E. Thomson, attd. K.O. Sco. Bord.; 2nd Lieut. R. H. Upson, R.W. Surr. R. (T.F.); Temp. 2nd Lieut. H. W. Gammon, Gen. List; Temp. 2nd Lieut. P. Evans, Gen. List. Dec. 31st: Temp. 2nd Lieut. H. Blythe, Gen. List; Temp. 2nd Lieut. A. Chapman, attd. E. Surr. R.; 2nd Lieut. F. E. Gritton, 21st Lond. R. (T.F.); Temp. 2nd Lieut. W. O. Cornish, Gen. List; Temp. 2nd Lieut. O. W. A. Manning, Gen. List.

Adjutant.—Capt. G. D. Yeatman, Dorset R., from Nov. 1st to Dec. 24th.

Park Commanders.—From Equipment Officers, 1st Cl., and to be Temp. Majors whilst so employed:—Nov. 1st: Capt. F. L. Scholte, S.R.; Qmr. and Hon. Lieut. (Temp. Capt.) F. H. Unwin, R.F.C. Qmr. and Hon. Lieut. (Temp. Capt.) A. H. Measures, R.F.C.; Dec. 6th.

Equipment Officers, 2nd Class.—From the 3rd Cl., and to be Temp. Lieuts. whilst so employed: 2nd Lieut. O. W. Latimer, Gen. List; Dec. 15th. 2nd Lieut. S. S. Dixon, S.R.; Jan. 1st.

3rd Class.—Temp. 2nd Lieut. T. H. McArthur, K.O. Sco. Bord., and to be transfd. to Gen. List; Jan. 1st, 1917.

Flight-Commanders.—From Flying Officers, and to be Temp. Cpts. whilst so employed: 2nd Lieut. W. E. Young, Dorset R., S.R.; Jan. 1st, 1917. Temp. Lieut. W. G. S. Curphey, M.C., Gen. List; Jan. 8th, 1917.

Flying Officers.—Dec. 16th: Lieut. G. T. Morris, Ayrshire R.H.A. (T.F.); Temp. 2nd Lieut. A. C. Pepper, Worc. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. F. A. Matthews, R. Suss. R.; Dec. 17th. Dec. 18th: Capt. N. C. Riddell, R. Scots (T.F.); 2nd Lieut. F. Stedman, Ind. Army Res. of Off.; 2nd Lieut. F. R. Evans, Ches. R., S.R., and to be sec'd.; 2nd Lieut. R. Robertson, Hamps. R. (T.F.). 2nd Lieut. D. T. Steeves, S.R.; Dec. 28th. Dec. 31st: 2nd Lieut. W. E. Young, Dorset R., S.R., from a Flying Officer (Ob.), with seniority from June 12th; Temp. 2nd Lieut. S. J. Oliver, Gen. List; Lieut. W. B. McDonald, 72nd Canadian Inf. Bn.; 2nd Lieut. A. A. Duffus, High. Brig., R.F.A. (T.F.). Jan. 1st, 1917: Temp. Capt. S. W. Vickers, Ches. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. D. P. Walter, Gen. List; Temp. 2nd Lieut. A. W. Erlebach, Gen. List; Lieut. T. D. Campbell, Canadian Machine Gun Serv.; 2nd Lieut. (on prob.) R. E. Adeney, R.W. Surr. W., S.R., and to be sec'd.

Balloon Company Commanders (graded as Squadron Commanders).—From Flight-Comdrs., and to be Temp. Majors whilst so employed: Temp. Capt. R. L. Farley, Gen. List; Jan. 1st, 1917. Lieut. (on prob.) (Temp. Capt.) E. J. E. Hawkins, Ind. Army Rse. of Off.; Jan. 5th, 1917. Graded as a Flight-Comdr.: 2nd Lieut. (Temp. Capt.) W. Wallace

Northumbrian Brig., R.F.A. (T.F.), from a Balloon Officer, and to retain his temp. rank whilst so employed; Dec. 5th.

Balloon Officers.—Dec. 28th: 2nd Lieut. V. M. Montague-Smith, S. Staff. R. (T.F.); 2nd Lieut. S. S. Stone, W. York R., S.R., and to be sec'd.; 2nd Lieut. D. C. Bell, Middx. R. (T.F.); 2nd Lieut. E. St. T. W. Freer, Suff. Yeo. (T.F.); 2nd Lieut. H. C. Fulcher, Sig. Serv. (T.F.); 2nd Lieut. (on prob.) C. W. Fidler, Arg. and Suthd. Highrs. (T.F.); Temp. 2nd Lieut. S. Pickford, Gen. List.

Adjutant.—Lieut. C. H. Waring, 18th Hrs., S.R.; Dec. 31st.

Park Commander.—The appointment of Capt. (Temp. Major) F. Jolly, S.R., is antedated to Oct. 25th.

Special Appointment (graded as a Park Commander).—2nd Lieut. (Temp. Capt.) F. C. V. Laws, Linc. R., from an Equipment Officer, 1st Cl., and to be Temp. Major whilst so employed; Dec. 22nd.

Equipment Officers, 2nd Class.—From the 3rd Cl., and to be Temp. Lieuts. whilst so employed:—Jan. 1st, 1917: 2nd Lieut. C. N. Seemann, S.R.; Temp. 2nd Lieut. J. K. Mountain, Gen. List; Temp. 2nd Lieut. C. K. Shepherd, Gen. List; Temp. 2nd Lieut. D. B. Cleghorn, Gen. List; 2nd Lieut. J. Kemper, S. Lan. R. 2nd Lieut. T. L. F. Burnett, S.R.; Jan. 7th, 1917.

Equipment Officers, 3rd Class.—2nd Lieut. C. W. Olliver, S.R.; Oct. 20th. Temp. 2nd Lieut. C. F. Wormull, Gen. List; Oct. 22nd. 2nd Lieut. S. G. Elliott-Smith, S.R.; Nov. 14th. 2nd Lieut. H. F. Wilkinson, S.R.; Nov. 16th. Temp. 2nd Lieut. A. W. Armstrong, Gen. List; Dec. 7th. Qmr. and Hon. Major J. Liddle (T.F. Res.); Dec. 29th.

London Gazette Supplement, January 22nd.
Flight Commander.—2nd Lt. (Temp. Lt.) E. M. L. Ainslie, Middx. R. (T.F.), from a Flying Officer, and to be Temp. Capt. whilst so employed; Dec. 31st.
Flying Officers.—2nd Lt. (Temp. Capt.) R. T. H. Watson, E. Kent R. (T.F.); Nov. 18th. Temp. 2nd Lt. C. C. F. Osborn, Bord. R., and to be transferred to Gen. List; Dec. 4th. Dec. 7th: Temp. 2nd Lt. N. A. Lawrence, attd. R. Fus.; Temp. 2nd Lt. G. E. Browne, British W. Indies Regt., and to be transferred to Gen. List. 2nd Lt. (Temp. Capt.) H. W. Kingdon, Hamps. R. (T.F.); Dec. 10th. 2nd Lt. F. P. Scott, E. Rid. of York. Yeo. (T.F.); Dec. 11th. Temp. Lt. E. S. Howells, Welsh R., and to be transferred to Gen. List; Dec. 13th. Temp. 2nd Lt. J. Angus, attd. Gord. Highrs.;

Dec. 14th. Temp. 2nd Lt. E. H. King, attd. R. Fus.; Dec. 15th. Dec. 28th: Temp. 2nd Lt. W. A. G. Young, Gen. List; Temp. 2nd Lt. L. W. Barney, Gen. List. Temp. 2nd Lt. T. C. Arnot, Gen. List; Dec. 29th. Dec. 30th: Capt. J. E. A. O'Dwyer, Notts. and Derby R., and to be seconded; Lt. E. A. Fawcus, Northd. Fus. (T.F.).

Equipment Officers, 3rd Class.—2nd Lt. J. Morris, from Unattd. List (T.F.), and to be Temp. 2nd Lt., Gen. List; Dec. 6th. (Substituted for the notification in the *Gazette* of Jan. 9th, 1917.) Temp. 2nd Lt. (on prob.) J. L. Denman, Gen. List; Nov. 20th. Temp. Qmr. and Hon. Lt. C. A. E. Lloyd, Gen. List; Dec. 18th. Jan. 1st, 1917: 2nd Lt. F. T. Sinclair, Welsh Divl. Engrs., R.E. (T.F.); 2nd Lt. F. C. Berkeley, S.R.; Temp. 2nd Lt. F. Knight, Gen. List; Temp. 2nd Lt. T. J. Legate, Gen. List; Temp. 2nd Lt. S. McLaughlin, Gen. List.

Central Flying School.

London Gazette Supplement, January 22nd.
Assistant Commandant (graded as a Wing Commander)—Capt. (Temp. Major) G. A. K. Lawrence, D.S.O., R.A., a Squadron Comdr., and to be Temp. Lt.-Col. whilst so employed, vice Capt. (Temp. Lt.-Col.) G. E. Todd, Welsh R.; Jan. 1st, 1917.

Aeronautical Inspection Department.

London Gazette Supplement, January 17th.
R. S. Owen to be Temp. Hon. Lieut. (without Army pay or allowances) whilst employed as an Asst. Insp., Aeronautical Inspn. Dept.; Dec. 1st.

London Gazette Supplement, January 17th.
Assistant Inspector.—2nd Lieut. J. A. O'Brien, Lond. R. (T.F.), from an Equipment Officer, 3rd Cl., and to be Temp. Lieut. (without the pay and allowances of that rank) whilst so employed; Dec. 11th. (Substituted for the notification in the *Gazette* of Jan. 4th, 1917.)

London Gazette Supplement, January 20th.
E. T. Eastwood to be Temp. Hon. Lieut. (without Army pay or allowances) while employed as an Assist. Inspectr., A.I.D.; Jan. 1st.

London Gazette Supplement, January 22nd.
E. A. Wraight to be Temp. Hon. Lt. (without Army pay or allowances) whilst employed as an Assistant Inspector, A.I.D.; Dec. 9th.



THE ROLL OF HONOUR.

Reported by the Admiralty:—

Killed.

Flight Sub-Lt. R. H. K. Vallings, R.N.

Died of Injuries.

F 8633 1st Grade Air-Mech. W. T. Hollidge.

Missing.

Flight Sub-Lt. W. H. Peberdy, R.N.

Slightly Injured.

Flight Officer H. W. Lee, R.N.

H.M.S. "Ben-my-Chree."

Wounded.

239876 (Ch.) A.B. E. A. Bennison.
182716 (Ch.) Ldg.-Seaman W. Billett (R.F.R. B. 5650).
286 W.T.S. L. Farthing, R.N.R., Wireless Telegraph Operator, 1st Cl.
F. 4153 1st Air-Mech. F. C. Tolley.
A.B. C. Greeney (specially entered Mercantile Rating).

Reported by the War Office:—

Killed.

2nd Lt. G. A. Exley, K.O. (Yorks. L.I.) and R.F.C.
2nd Lt. R. Hopper, R.F.C.
1568 Corpl. G. Dinnage, R.F.C.
11378 Pte. A. Rogers, R.F.C.

Died of Wounds.

7768 2nd Air-Mech. R. Oxley, R.F.C.

Previously reported Missing, now reported

Died of Wounds.

Lt. W. B. Saint, R. Scots, attd. R.F.C.

Died.

17899 1st Air-Mech. T. Foye, R.F.C.
33125 2nd Air-Mech. R. G. Hughes, R.F.C.

Wounded.

Lt. G. W. N. R. Haynes, R. Munster F., attd. R.F.C.
Lt. S. G. Kingsley, R.F.C.
Capt. H. J. Segrave, Wilts., attd. R.F.C.
Lt. H. M. Yeatman, Wilts., attd. R.F.C.
381 Corpl. P. Browning, R.F.C.
22177 1st Air-Mech. L. V. Bulmer, R.F.C.
9152 2nd Air-Mech. J. Harrison, R.F.C.

Previously reported Missing, now reported Wounded and Prisoners of War in German hands.

2nd Lt. C. M. Kelly, R.F.C.
2nd Lt. J. K. Parker, R. Scots Fus., attd. R.F.C.
2nd Lt. A. B. Raymond-Barker, R.F.C.

Previously reported Prisoners of War, now reported Wounded and Prisoners of War in German hands.

2nd Lt. L. C. L. Cook, A.S.C. and R.F.C.
2nd Lieut. C. L. Roberts, S. Lancs., attd. R.F.C.

Missing.

2nd Lt. G. W. Bentley, R. Fus. and R.F.C.
2nd Lt. D. R. Hinkley, York and Lancaster, attd. R.F.C.

Previously reported Missing, now reported Prisoners of War in German hands.

2nd Lt. W. B. Clark, Yeomanry, attd. R.F.C.
2nd Lt. H. F. Evans, R.H.A. and R.F.C.
2nd Lt. H. B. O. Mitchell, M.C., R. Inniskilling F. and R.F.C.



Another Raider's Body Found.

A BODY, supposed to be that of a member of the crew of the Zeppelin brought down off the Durham coast in

November, was found on November 18th by a man at sea in a small boat. The body, which was decomposed and charred, was brought ashore and buried with military honours.

SOME PROBLEMS IN AEROPLANE CONSTRUCTION.*

By CAPT. V. E. CLARK, CAPT. T. F. DODD, and O. E. STRAHLMANN.

IN this paper we shall advance for discussion, with hopes of solution, some important problems connected with the construction of aeroplanes intended for military uses in the United States. Many of these problems also apply to aeroplanes built for commercial and sporting purposes. Although the lessons on type development that are being learned in the European War are of immense value to us, many conditions that we must meet are peculiar to this country.

MILITARY FUNCTIONS OF AEROPLANES.

We will first consider the various military functions (becoming more and more distinct), as we understand them at present. It must be borne in mind that other important uses will, in all likelihood, develop. The aeroplane itself and its uses in war are so new that it is impossible to predict, with any degree of accuracy, the developments in even a few months. At present the aeroplane is being used in war for reconnaissance, fire control, rapid transportation of important officers or communications, demolition of valuable structures by bombing, and to attack hostile aeroplanes in order to prevent them from performing these functions.

1A. *Strategical-reconnaissance machines.*—For this work the fuel capacity should insure a flight of at least 500 miles without stop. The average speed during this flight should not be less than 80 m.p.h. The *military load* consists of one pilot, one observer, a sketching outfit, a camera, a wireless set and navigating instruments. The general rule is becoming more and more firmly established that no military aeroplane should be entirely defenceless against the attack of hostile aeroplanes. This and all other service types should carry one or more machine guns, and the general arrangement of the system should be such as to permit extensive fields of fire in important directions. The useful load, that is, fuel plus the *military load*, and the speed range, determine the power required. A power plant of about 200 h.p. would apparently satisfy most economically this problem, the primary requirements of the power plant being reliability and fuel efficiency. Assuming this, the fuel will weigh between 700 and 800 lbs. The *military load* will be almost 600 lbs. The complete aeroplane, fully loaded, will weigh over 3,500 lbs. This aeroplane would also be adapted for long-distance transportation of important communications or officers.

1B. *Tactical-reconnaissance machines.*—The fuel capacity of this type should insure a continuous flight of at least 250 miles at a speed of not less than 85 m.p.h. The *military load* should be about the same as that carried in the strategical-reconnaissance machine. A power plant of about 125 h.p. is desired, the primary requirement being reliability. The fuel will weigh about 225 lbs., the aeroplane, loaded, somewhat less than 2,400 lbs.

2. *Field Artillery fire control.*—The tactical-reconnaissance machine can perhaps perform this duty, but it appears that the fire-control machine should be slower, and that one of its primary requirements should be an extremely good field of vision. The engine should be of 125 h.p., or perhaps less.

3. *Long-ranger bombers.*—We here attack a more difficult problem, owing to the heavy useful load with which we must climb from the starting field. There will probably be a wide range in sizes of machines intended for this duty. We will discuss what we might call an average type at the present time. The fuel capacity should permit going out at least 200 miles and returning safely, starting with a load of bombs weighing, say, 400 lbs. The machine should be capable of defending itself from hostile aircraft, so that it can operate independently of escort. It appears that we need at least 250 h.p., and that, depending upon the total useful load, 300 h.p., or even 350 h.p., would not be too great. If we assume 300 h.p., the fuel weight will be at least 900 lbs. and the total *military load*, including bombs, about the same. This aeroplane will weigh, loaded, between 5,000 and 6,000 lbs.

4. *Pursuit machines.*—The function of this type is to attack and drive off hostile aeroplanes of any of the three first-mentioned types, preventing them from accomplishing their purpose. In fact, the employment of this type should afford a sort of offensive defence against hostile aircraft of all descriptions. While the types 1A, 1B, 2 and 3 are interested primarily in objects on the ground, the pursuit type is occupied solely with events in the air. This type is at present divided into the one- and two-place sub-classes:—

(a) The one-place machine carries fuel for 2 hours at full speed, about 130 m.p.h. The pilot is the only occupant. He controls the machine and operates the machine gun,

or guns, of which there can be from one to four. He usually aims the gun, in action, by "pointing" his aeroplane. All characteristics are sacrificed to reasonable limits in order to obtain rapid climbing ability, high speed, rapid climbing ability at high speed and the greatest possible dodging ability, or "handiness." In the engine, reliability must be sacrificed to a great extent to obtain low weight per horsepower, in order that the necessary attributes of the aeroplane can be obtained. Between 90 and 130 h.p. is desired. At present by far the greatest percentage of engines in this type of machine are of the rotary air-cooled type.

(b) The two-place machine carries fuel for 3 hours at full speed, about 110 m.p.h. Space is provided for two men, the pilot and the gun operator. This is, of course, somewhat larger and less agile than the one-place machine, and, it is believed, is rapidly losing its popularity in favour of the smaller type. The power required is from 110 to 160 h.p.

5. *Oversea reconnaissance.*—(a) The long-range machine of this type must carry fuel for 6 hours at not less than 75 m.p.h. Two men, wireless-transmitting set and navigating instruments are carried. The 300 h.p. plant used on the bomber should answer for this type satisfactorily, the greatest requirements being reliability and fuel efficiency.

(b) The machine used for short-range reconnaissance and coast artillery fire control must carry fuel for 3 to 4 hours at speed of not less than 75 m.p.h. Two men, navigating instruments, wireless and other signalling apparatus will be required. The 200 h.p. engine used in the land strategical-reconnaissance machine should answer.

SOME PROBLEMS IN CONSTRUCTION.

It is important that engineers work out the mechanical details of a great many problems in construction, among which are the two-propeller system, the reduction of vibration, the development of light engine starters, gasoline supply systems, devices required for safe landing and improvements in wing and propeller design.

The two-propeller system.—When an all-round field of fire is necessary, the best arrangement is to carry the two or three operators and the main supply of gasoline in a central body and to drive the machine by two propellers, one at each side of this central body. By such an arrangement machine guns can be fired forward, in attack, and to the rear, in retreat, with extensive fields of fire in both directions, above and below, to right and to left. This attribute is always desirable, and, in some types, as for instance in the bombers and reconnaissance machines, is essential. These propellers can be either tractor screws or "pushers." The left-hand propeller should turn clockwise and the right-hand propeller counter clockwise. This symmetrical arrangement is a great advantage, in that it permits, equalised torque and gyroscopic effects when turning in different directions. In addition, it makes for safety, because the downward velocity imparted to the inboard parts of the two slip-streams that strike the horizontal tail surfaces produces an inherent tendency toward nose heaviness without power and toward tail heaviness with power. We can, therefore, design so that the line of thrust is considerably above the centre of gravity, compensating for this, and obtaining another convenient feature. A fourth great advantage of such a system is the fact that great power can be transmitted with good propeller efficiency without demanding excessive diameter and retaining satisfactory structural safety factors. It is highly desirable that the line of thrust of the propeller be kept below the centre of gravity of the aeroplane, unless the two-propeller arrangement, as described above, be used; a propeller of large diameter, with sufficient clearance, necessitates a high landing gear with its many great disadvantages. It appears extremely difficult to build a propeller of wood, of satisfactory strength (if the speed of revolution be high), giving good efficiency, to transmit more than 160 h.p. Peculiarly stringent climatic conditions making for rapid deterioration have increased this difficulty. In fact, the tendency to reduce cylinder diameter and increase crankshaft revolution speed is already necessitating a gear between crankshaft and propeller-shaft in order to keep the propeller speed below 1,300 r.p.m., which is considered desirable. A fifth advantage of the two-propeller arrangement is that the total resistance of the air to progress through it of the complete aeroplane while flying under power will be diminished owing to the fact that less total projected area of bodies will lie in the propeller slip-streams. The velocity of the air striking objects lying in the slip-stream is, say, 20 per cent. higher than the velocity of air not in the slip-stream. The resistance varies about as the square of the velocity. There-

* A Paper read before the American Society of Automobile Engineers.

fore, all other things being equal, less power will be required to overcome the total resistance.

Arrangements with two propellers.—Four different systems for two-propeller installation have been suggested:—

1. Two engines, one on each side, mounted out on the wings. The fundamental weakness of this system is that these great masses, removed so far from the centre of gravity of the aeroplane, produce great moments of inertia, and consequently slow periods of oscillation. The machine is "logy" and probably not satisfactory for any but "hydro" purposes, in which case a "snappy" machine is impossible at best.

2. Two engines mounted in the central body between pilot and observer, each driving its own propeller through bevel gears and shafts, or by other method, the two systems being independent.

3. One large engine, mounted in the central body, driving both propellers, one propeller at each side.

4. Two engines, mounted in the central body, with a system of clutches connected with the transmission system in such a manner that either engine, or both engines, can drive both propellers, it being possible for the pilot to shift during flight.

The last system presents many advantages over the others, but it is entirely possible that excessive weight and complexity will render it impracticable. The system, as a whole, must be reliable.

In the design of any system of transmission for the two-propeller arrangement the engineer must bear in mind that the structure of the wings supporting the propeller and transmission is very light and rather flexible, usually vibrating during flight.

The information at hand indicates that, to date, no successful aeroplane of the two-propeller type has been developed, but it is urged that the possible advantages are such as to warrant great effort on the part of engineers toward this improvement.

Methods of reducing vibration.—The problem of reducing vibration of the aeroplane in flight, initiated by the engine, is a serious one. It is difficult to realise, without actual experience, the viciousness of this vibration, especially when the engine is of the eight-cylinder type, even though it is running normally. After one experiences this vibration, it is easy to understand why ignition systems, gasoline-supply joints, water-cooling systems, delicate instruments, and even wire terminals and structural joints of the aeroplane itself, deteriorate so rapidly. The vibration throughout the aeroplane can, of course, be reduced by better design of the engine mounting, but we cannot hope to eliminate it entirely in this manner, if the engine itself is not of the proper design.

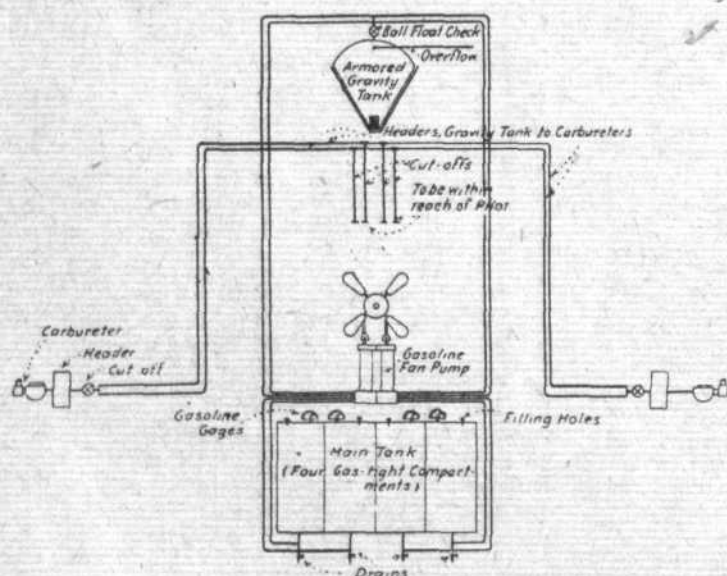


Fig. 1.—Gasoline supply system (suction pump) for military seaplane.

We must not, in this connection, get the idea that the engine is always operating at the same speed during flight. We can, for instance, if flying at extremely high speed, turn the crankshaft over at, say, 2,000 r.p.m.; whereas, if our sole object is to remain in the air without losing altitude, as when spotting for artillery fire, we can use a crankshaft speed of, say, not more than 1,200 r.p.m. The vibration at any speed should not be excessive.

Starting motor for engines.—The development of light

starters is a matter of immediate importance. For instance, a seaplane equipped with two engines, one out on each wing, would be utterly useless without reliable starters. It seems quite probable that electric starters will be preferable, if the weight can be reduced sufficiently, and if the danger of spilling electrolyte be eliminated. It appears that any engine of over 140 h.p. requires a starter. Reliable provision for starting the engine in extremely cold weather is necessary.

Gasoline supply system.—To date none of our pilots is anxious to fly cross country with any except gravity feed. The gasoline-supply system, Figs. 1 and 2, required by the United States Army for twin-engine seaplanes, is as follows:—

The flow of fuel shall be from the main supply tank in central body to the gravity service tank located at the centre of the upper wing; from gravity service tank by gravity, along the lower wing panels, to the small headers at the carburetors of the two engines, and from the small headers in each case to the carburettor. These tanks shall have fuel capacities sufficient for operation at full-rated power, as follows:—Main supply tank, 4 hrs. 35 mins.; gravity service tank, 25 mins.; each header to carburettor, 1 min. The design and material of the gasoline supply system throughout shall be such as to obtain extreme lightness as far as consistent with strength and resistance to corrosion.

Main gasoline supply tank in central body.—This shall be divided by one vertical longitudinal bulkhead and one vertical transverse bulkhead into four gasoline-tight compartments. Proper swash-baffle plates shall be installed. The tank shall be of sturdy construction throughout. The main tank shall be of such shape as to properly fit the central body. It shall be securely fastened in the structure of the central body in such a way as to be undisturbed by any possible motion of the aeroplane. The structure shall be such that the tank will withstand an internal pressure of at least 7 lbs. per square inch without leakage of gasoline. The design shall be such that there will be no ill effects from drumhead vibration. Suitable means shall be provided for quickly and conveniently filling and for completely draining all four compartments. Each filling hole shall have a suitable screen filter, 100 mesh to the inch. Plugs or caps for filling holes shall be airtight and provision shall be made for "safetizing" them positively in place. Suitable gaskets shall be used. Provision for reducing to a minimum the rate of leakage due to bullet holes by lining the inside of the tank with a special material, is highly desirable. Suitable gasoline-supply gauge shall be installed. There shall be leads from the bottoms of the four compartments to the upper gravity service tank.

Supply of gasoline from main to gravity service tank.—This shall be by two methods:—First: Air-fan driven pump, so

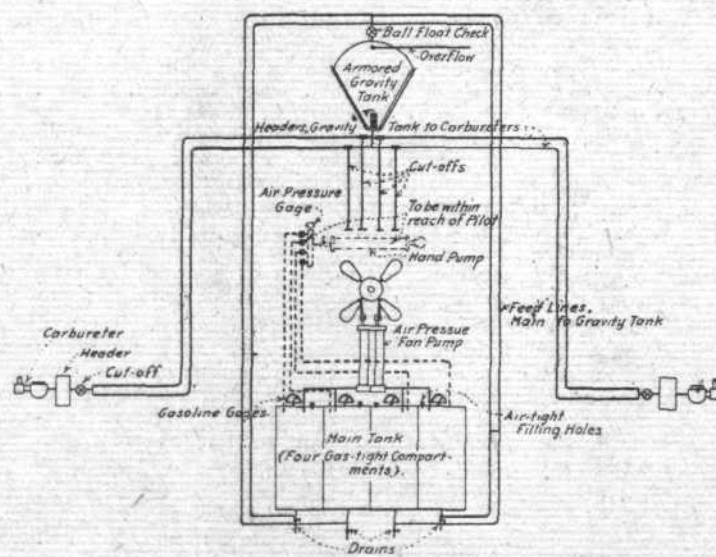


Fig. 2.—Gasoline supply system (air pressure) for military seaplane.

designed as to maintain proper air pressure in or suction from the main tank system, and to operate satisfactorily during flight. An alternative and better method will be to instal two such fans, each fan maintaining pressure in any two of the four compartments of the main tank. When any one or two of the four compartments of the main tank leaks (because of bullet hole or through other cause), an arrangement by which pressure or suction can be maintained through the leads from the tight compartments is highly

desirable. Second: A hand air-pressure pump in or at the side of the pilot's cockpit, which can be used when not in flight or in an emergency. This pump shall be located in the cockpit at a point as high as will permit convenient operation by the pilot in his seat. It shall be provided with a suitable air-pressure gauge, visible to the pilot. Its connections with the compartments of the main tank shall be at a point as high as practicable to prevent the pump becoming flooded with gasoline. An arrangement by which pressure can be maintained by the hand air-pressure pump on tight compartments of the main tank when one or two compartments leak is highly desirable.

Construction of gravity service tank.—This tank shall be of sturdy construction, securely supported in place, and provided with the proper number of swash-baffle plates. It is considered desirable to protect this tank with light V-shaped armour on the under side. An automatic ball-float valve shall be provided to prevent overfilling of this tank. A suitable overflow pipe out of the top centre of the gravity service tank shall be provided. The gravity service tank shall be of good stream-line form. A suitable gauge, visible to the pilot in his seat, shall be in the gravity service tank. This gauge shall be connected at such a point that it will register accurately through the range of normal flight attitudes. From the gravity service tank the gasoline shall be led to a small header at each engine by leads within or along the lower wing panels. Between gravity service tank and each header shall be two independent, and, as far as practicable, isolated tube leads. Each of these four leads shall connect with the lower part of the gravity service tank at such a point that the supply will not be interrupted at any normal flight attitude. At the connection of lead to the gravity service tank shall be a suitable wire gauze strainer, mesh 100 to the inch. Provision shall be made to prevent the possibility of air pockets in the gasoline leads from the gravity service tank. Provision shall be made for permitting the pilot, while in his seat, to cut off the gasoline supply, through all leads, from the gravity service tank to the carburettor headers.

Headers between carburettor and service tank.—A small cylindrical or stream-line tank or header shall be installed in the immediate vicinity of each carburettor. The gasoline shall pass through this header after coming from the gravity service tank. Its capacity shall be sufficient for one minute's running at full-rated horse-power. The central portion of this header shall be on a level with the jets of the carburettor. The axis of the cylinder shall be vertical. The cylinder shall be of sufficient length to give satisfactory head, either when the aeroplane is in normal attitudes or when it is upside down. Provision shall be made to prevent gasoline from backing up into the service lead instead of coming into the carburettor when the engine is upside down. Suitable gasoline cut-off shall be installed near this header in such a position as to be convenient for operation to a man standing on the ground or on the wing.

Tubing for fuel leads.—At every point these shall be of the highest grade material best suited for the purpose. It shall be approved by the inspection department. Flexible tubing shall be $\frac{3}{16}$ -in. No. 2 copper tubing. Non-flexible leads shall be piping as approved by the inspection department. Tubing shall in all cases be of diameter sufficient to give free and continuous flow under severe vibratory conditions. In the absence of other instructions, the bore shall be $\frac{3}{16}$ in. All tubing shall be securely fastened in such a way as to resist wear, vibration and chafing. The number of joints and fittings shall be reduced to a minimum. Unions, elbows, tees and fittings to be S.A.E. standard, approved by the inspection department. The method of connecting all leads shall be approved by the inspection department. All fittings shall be readily accessible for inspection, adjustment, repair or removal.

It will be seen that it will require considerable ingenuity to work out satisfactorily the mechanical details of this complicated arrangement. For instance, a satisfactory method of insuring feed from the compartments of the main tank, up to the gravity tank, when one or more of the main compartments are punctured by shot, is required.

(To be continued.)

FIVE CENTURIES OF AIRCRAFT.

THERE was opened to the public by Brigadier-General W. S. Brancker, Director of Air Organisation, on Wednesday this week the exhibition at the Grosvenor Galleries, Bond Street, which has been organised by Lady Drogheda in aid of the Flying Services Fund and the Irish Hospitals Supply Depôts. The exhibits, as foretold last week, embrace everything that perseverance and generosity of lenders could possibly get together appertaining to the conquest of the air, and include pictures, models, actual appliances and relics.

The long entrance corridor and the four rooms of the Gallery are well filled, and the exhibits are displayed in a thoroughly businesslike, though interesting, manner, so that one may walk round and follow the growth of aviation from the very earliest days up to a few months back, as exemplified by parts of "L. 33" and the Fokker.

In too many instances at exhibitions of this nature pictures are the least interesting of the things on view, and appear to have been gathered together for the sole purpose of covering what would otherwise be blank space. Not so with those under notice. They are both interesting and instructive, even to those engaged in the science of aeronautics or the aeronautical industry, and considerable labour must have attached to the collecting and labelling of such a vast array.

The complete Fokker, with steps and platform on each side, to facilitate inspection, will no doubt prove the attraction to the general visitor. Of other aircraft there are many models, from small gold and silver presentation ones, to the remarkable "Silver King" airship scale model of Messrs. Thos. Parsons and Sons, and the graceful biplane, with its 8 or 10 ft. span, sent by Messrs. Vickers.

Relics of the various Zeppelins brought down in this country seem to possess still further interest now that they

can be approached closely, a privilege not accorded during the previous public exhibitions.

The electric bomb-dropping device that created so much interest when it came into British hands, has here been rigged up in complete form on a tripod, with battery and push button complete. One may therefore become acquainted with the exact operation, by pressing the button, and dropping the bomb—empty, of course—on to the felt mat placed beneath it.

It would be impossible to describe in detail the hundred and one exhibits to be seen, indeed it would be against policy to do so, seeing the good cause to which the entrance money is to be put. This we may say to those who read this short notice, and who are no doubt engaged in some form or other with the great science, that even to the most well informed in matters aviatric here is an exhibition that will well repay a visit.

The whole exhibition might be labelled as "strictly business," which, in these times of war, is as it should be.

Not least interesting is the catalogue, and by way of prophecy Mr. G. H. Wells in a preface says:—"When a hundred years hence the Lady Drogheda of that day opens her revival of this show—I hope for some quite other cause than the Red Cross—I doubt if there will be much to add to the balloon and airship series (of pictures). It will be pictures of multiplanes, helicopters, and every sort of great aeroplane, that will make the bulk of the matter added to what we have here to-day."

Countess Drogheda is to be congratulated on her exhibition, and to her is due the thanks of all interested in aviation for the ungrudging amount of time given and trouble she has taken in getting together this unique display, and the very practical way the exhibits have been arranged.

"The Flying Machine."

THERE will be many of our readers who will welcome this latest volume of Mr. F. W. Lanchester, for it is a reprint, brought up to date, of his James Forrest Lecture before the Institution of Civil Engineers, together with the paper on "The Theory of Sustentation and Expenditure of Power in Flight" which was contributed to the International Engineering Congress at San Francisco. In "The Flying Machine from an Engineering Standpoint," problems in mechanical

flight are dealt with, which come more directly within the purview of the aeronautical constructor, matters such as the theory of stability being taken, in the main, for granted. In its present form the book is one which will be found extremely useful by engineers and draughtsmen who are turning their attention to aviation, and do not want to devote a great deal of time to studying aerodynamical theories. The book is well illustrated by a very large number of diagrams. It can be obtained from "FLIGHT" offices for 4s. 11d., post free.

AIRCRAFT WORK AT THE FRONT.

OFFICIAL INFORMATION.

British.

War Office, January 22nd.

"East Africa.—From north and south our troops have entered the delta near Pemea and at Mohoro respectively.

"Further west a strong enemy force, dislodged from the area north of the delta, was located by aeroplane on the south bank of the river, near Mpanganya (38 miles up stream from Mohoro).

"Mesopotamia.—On the 20th inst. our aeroplanes carried out a raid on the Turkish munition factory situated in the citadel at Baghdad. Six 100-lb. bombs were dropped in and around the factory."

General Headquarters, January 23rd, 8.35 p.m.

"Our aeroplanes were active yesterday in co-operation with our artillery. One of our machines is missing. On 21st inst. an enemy machine was forced to descend in the neighbourhood of Aubigny."

French.

Paris, January 23rd.

"Yesterday during the day one of our pilots brought down a German aeroplane, which fell in our lines near the Navarin Farm. In the region of Montmédy another German machine, which was attacked by one of our aeroplanes with a machine-gun at short range, fell to the ground in the enemy lines near Hamel."

Russian.

Petrograd, January 16th.

"Our aviators dropped bombs on Barjami and Sudami, on the Danube, in the region of Braila, and caused fires on some vessels."

Petrograd, January 22nd.

"In the neighbourhood of our positions south of Brshezany,

Lieut. Grasse, an aviator of the French service, attacked a German aeroplane which fell into the enemy's position near the village of Komorokhi (on the River Nairaiuvka)."

Italian.

Rome, January 17

"On the morning of the 14th inst., near the Dalmatian Islands, an Austrian vessel was torpedoed and sunk by a French submarine attached to the Italian naval forces.

"The submarine was unsuccessfully attacked by an Austrian aeroplane."

Belgian.

Havre, January 20th.

"The operations of Belgian aviators have been hampered by snow and mists. We have, nevertheless, carried out pursuing flights above the enemy's lines."

German.

Berlin, January 17th.

"In spite of the fact that the unfavourable weather conditions considerably restricted aerial activity in the middle of December, our airmen and anti-aircraft formations succeeded in causing considerable losses to the enemy. We lost 16 aeroplanes, whereas our enemies lost 66, of which 48 were brought down in air fights, 16 were shot down from the ground, and two were forced to land. Twenty-two of these machines are in our possession, while 44 were observed to fall on the other side of the line."

Bulgarian.

Sofia, January 16th.

"Lieut. Burchardt brought down a British aeroplane in the Strumnitza Valley."

THE IMPORTANCE OF GOOD FLOORING.

ONE point at which those who are considering the question of factory extensions are often tempted to cut expense is in connection with flooring. It is, however, false economy to think that anything but the best is good enough for the floor if real satisfaction is expected. This is especially true in the case of aircraft workshops, where it is not only important that the floor should wear perfectly true and level but also that dust should be, as far as is humanly possible, eliminated.

Attention may therefore be drawn to what is termed the Master Builder's method of flooring, for which Messrs. John Jones and Co., 32 and 33, Avenue Chambers, Southampton

and from what can be seen from samples which we have inspected these claims appear to be borne out in a remarkable way. Moreover, those firms which have tried it, and it has been used in the extensions of the Bristol Factory at Filton, speak very highly of the results obtained.

The photograph reproduced shows a floor being laid by this method in a motor rim factory at Birmingham, and after three years' hard and continuous wear the owners of the factory report that it appears to be even better than when it was laid.

From the point of view of the aircraft manufacturer, perhaps the strongest claim, next to that of hard wear, of the



A floor being laid—by the Master Builder's Method—in a motor rim factory at Birmingham.

Row, W.C., are the sole agents. The essential feature of the Master Builder's method is that, incorporated in the top layer of concrete is a hardener, which is a finely crushed mineral product, with the result that the surface is finished as smooth as slate or stone. Also, the fine metallic particles of the material being brushed into the pores of the concrete base expand when acted upon by moisture, thus forming a mechanical bond between the base and the topping. It is this same expansion in the bonding which gives the water-proof qualities of the material in the topping.

It is claimed for the Master Builder's method that it is dust-proof, wear-proof, water- and oil-proof, and fire-proof,

Master Builder's method is the absence of dust. As is well known, the dust which is created by an ordinary granolithic floor is often so serious that various remedies have to be resorted to in order to keep it within reasonable limits. In the Master Builder's method, however, the surface is so smooth—but not slippery—and steel hard that there is practically no dust.

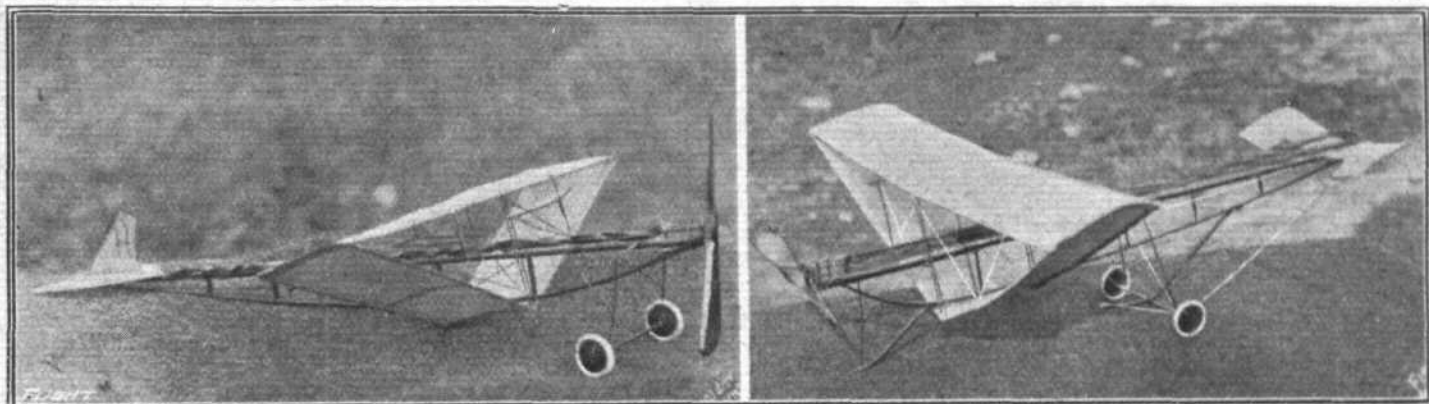
Messrs. John Jones and Co. either supply the "Hardener" for mixing with the concrete or they will contract for the laying of floors by their method, while at any time they are ready to place their experience at the disposal of those who have the question of flooring under consideration.

Models

A "Triangle" Plane.

FROM Lieutenant C. C. Horner comes the accompanying photographs of models which he made while serving in the R.F.C. some time ago. They are improvements on the C.C.H. triangle plane which he originally designed in 1909.

thrust on screw as before, but the results being vastly different, only getting 20 yards at about an altitude of not more than 3 ins.—more like a grasshopper than anything. Most likely the camber has a lot to do with it, but the thing is what has it to do with it?



Two triangle plane models with which Lieut. C. C. Horner has been experimenting.

The pusher type flies from 200 to 300 yards, while the tractor does about 100 yards and is very stable.

A Scale Model.

In sending along the two photographs, reproduced herewith, of a model tractor biplane, which he has designed and constructed, Mr. E. H. Hammond gives the following particulars:

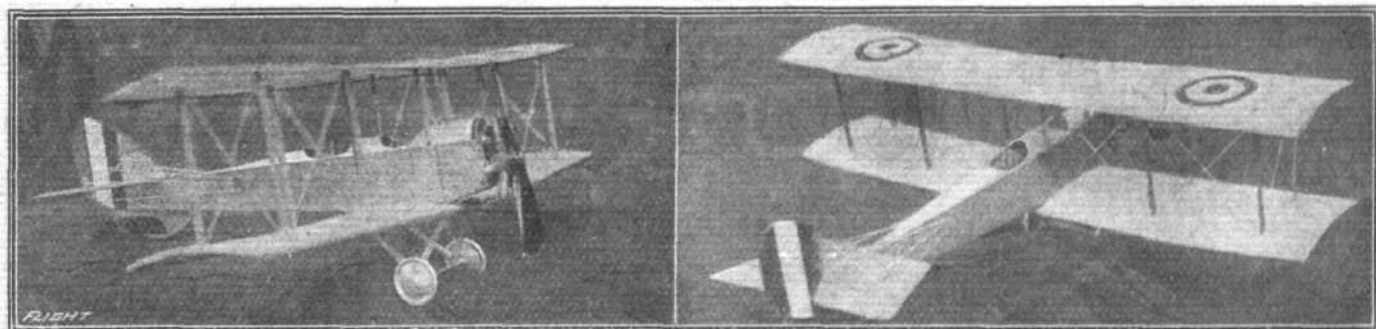
The measurements are: Length of main planes, 24 ins.; gap, 4 ins.; chord, 4 ins.; length of fuselage, 18 ins. It has also a model Gnome seven-cylinder engine, and also working controls. The only tools used were a fretsaw, drill, and screwdriver.

[Mr. Hammond asks for criticism on his work, and certainly from the photographs it appears that his model is one of the

"I will now take my second question. This relates to high and low centres of gravity.

"Where should a model balance in relation to the line of thrust either of a biplane or monoplane? Should the centres be above the line of thrust or below, and how much above or below, that is, to take the machine by the inside struts and balance so that the planes point up and down, not horizontal."

Reply.—1. "Eiffel's Resistance," &c., gives characteristics of various wing-sections. This book can be seen at the leading public reference libraries. The smaller camber in the second model would not necessarily be the sole cause of the poor performance, as by reducing the loading and camber you have called for greater speed than before to obtain the



Two views of a scale model biplane made by Mr. E. H. Hammond.

best scale models we have seen for some time. The proportions are very good and the design up-to-date, while evidently great care has been taken in the workmanship.]

Replies to Queries.

Mr. F. J. Mabb, of Leeds, writes:—"Could you give any method to work upon relating to certain cambers and the amount of lift derived from various curvatures without resorting to wind-tunnel tests, an article, I am sorry to say, I do not and cannot at present afford to possess?"

"We all know that a cambered plane lifts much better than a flat one, the general rule being to load a model at so and so, but if one knew exactly what work was being done by, say, a plane of a small curvature and another of a deep camber, it would help one on with the study of aeronautics."

"I will take a point in question. Two years ago I constructed a scale Blackburn monoplane which was loaded rather heavily, carrying 12 ozs. to the square foot, but flew remarkably well for a scale model. I believe the best flight was close upon 100 yards r.o.g.; the span was 3 ins. with a chord of 8 ins. The camber here was $\frac{3}{4}$ in. at the deepest point situated one-third from the leading edge, planes double surface. Now I make another machine with improvements, and load it at 8 ozs. square foot, with a span of 42 ins. and chord of $6\frac{1}{2}$, the camber here being $\frac{3}{4}$ in. at deepest point situated in the same position as the first machine, same

necessary lift for the same propeller thrust. You might obtain good results by increasing the thrust, or, should you require a slower speed, by slightly increasing the camber. In any case, the camber should be kept as small as possible on models, no advantage being gained from big cambers.

2. Generally speaking, it may be taken that the centre of gravity should coincide as near as possible with line of thrust, anything above the line of thrust.

Mr. N. Kingsley-Pallant writes:—"In your issue of 'FLIGHT' dated September 7th last, you described, very briefly, the Sharp 2-stroke petrol engine for models. Would you be kind enough to send me a few further details? The approximate horse-power, diameter of propeller supplied, overall height, and greatest length of engine, &c. Also, can you tell me if a rigid airship made of wooden formers and hoops (approximate dimensions 12 ft. long x 18 ins. greatest diameter), having a capacity of about 20 cub. ft. of hydrogen, should have sufficient lift to take the weight of this engine, and if the engine would be powerful enough to drive it?"

Reply.—H.p. of engine about $1\frac{1}{2}$; height and length about 6 ins. x 3 ins.; propeller not supplied. Further particulars can be obtained from A. W. Gamage, Holborn. As 20 cubic feet of hydrogen would lift only about $1\frac{1}{2}$ lbs. you could not employ this engine, which weighs about 1 lb. 15 oz. complete. 1,000 cubic feet hydrogen lifts nearly 70 lbs.

AERO COMMITTEE OF THE S.M.M.T.

AN official notification from the Society of Motor Manufacturers and Traders, Ltd., states that, in the changes brought about by the war in the industry, which has been of such supreme value to the country viz., the motor industry in its numerous branches, the branch which has most developed during the war has been that connected with Aircraft. The output of Aero Engines in this country has enormously increased, with a corresponding demand for magnetos, &c. Practically a new industry has developed in magneto manufacture, whilst former carriage builders are, in many cases, now almost entirely engaged on Aeroplane work.

The Society has decided to form a fresh Aero Committee, and at a recent meeting of the Council representatives of the following members agreed to act:—Arrol-Johnston, Ltd.; Aster Engineering Co. (1913), Ltd.; British Thomson-Houston Co., Ltd.; Brown Bros., Ltd.; Clement-Talbot, Ltd.; Daimler Co., Ltd.; Dunlop Rubber Co., Ltd.; Green Engine Co., Ltd.; Humber, Ltd.; Lanchester Motor Co., Ltd.; Joseph Lucas, Ltd.; D. Napier and Son, Ltd.; Palmer Tyre, Ltd.; Simms Motor Units, Ltd.; Sunbeam Motor Car Co., Ltd.; Vauxhall Motors, Ltd.; Wolseley Motors, Ltd.

This Committee has power to add, and doubtless a number of other Members interested will appoint representatives.

The work of the Society's former Aero Committee is best known to the public through the Aero Exhibitions held at Olympia, by which the aircraft productions of those times were first brought together in this country. The war, of course, has stopped such exhibitions, but many new problems have arisen and are likely to arise before exhibitions recommence. The Society is at present engaged, in conjunction with the Institution of Automobile Engineers and representatives of Government Departments and other bodies, on steel research of great interest to manufacturers of all high-speed internal-combustion engines. The Under-Secretary of State for War has referred to this in Parliament, a Treasury grant having been made after the Society had guaranteed a certain sum.



"The Aeroplane Speaks."

This is a book which should ease the mind of many a budding pilot, and also help along many a mechanic who is in trouble with his machine. In the "prologue," which occupies about one-third of the book, Capt. Barber has conceived the fascinating idea of allowing the parts and qualities of the aeroplane to explain themselves. And right well they do it, so that any unmechanical reader can get a grasp of the essential idea, although he may not be able to fathom "the reason why." This part of the book is helped considerably by a great many diagrams, which are not just the skeleton-line diagrams, which do duty in so many text books, but pictures with a story. After the prologue follow chapters in which Capt. Barber explains the principles of mechanical flight, stability and control, rigging, the propeller, concluding with a chapter on maintenance and a useful glossary. In all these chapters Capt. Barber wisely has made extensive use of diagrams which are of great assistance in clearing up any doubtful points. The book is published by Messrs. McBride, Nast and Co., and it can be obtained from "FLIGHT" offices for 6s., post free.

"Aircraft of To-day."

HAVING extensive experience with balloon and aeroplane, and withal being blessed with the pen of "a ready writer," Mr. C. C. Turner is well qualified for the task, which he has tackled in "Aircraft of To-day," of providing the non-technical reader with a review of aeronautical progress up to date. As a matter of fact, the new book takes the place of his popular "Aerial Navigation," which was written some years ago and has therefore become hopelessly out of date. Mr. Turner deals briefly with the history of aeronautics and explains in simple language, with the aid of clear diagrams, the principles of mechanical flight and also of balloons and airships. He is also able to write at first hand of sensations during ballooning and during flying, while another instructive chapter is that on "Learning to Fly." Much useful information is given on the subject of the atmosphere and the navigation of the air. Besides a large number of diagrams in the text, there are several reproductions of photographs, &c. The book is published by Messrs. Seely, Service and Co., and can be obtained from "FLIGHT" offices for 5s. 5d., post free.

AN IMPROVED "CHEMICO" BODY SHIELD.

It is, roughly speaking, about a year ago that the County Chemical Co., of Birmingham, brought out their "chemico" body shield for the protection of our troops fighting the cause of civilisation. We had occasion then to speak well of the tests through which it successfully came. Last week the company invited inspection of an improved pattern of this valuable aid to protecting life, and again it showed enormous resisting powers against both revolver and bayonet. In the new shield the weight has been reduced, so that the full body, back and front, can now be protected at comparatively a small poundage. From evidence of users in the fighting line, the shield already has a long list of lives saved to its credit, and irrespective of its commercial possibilities it undoubtedly should have from a humane point of view a great and immediate future in the present state of world war. In regard to its application to our flying services, its value should be especially marked, as an extra pound or two is not of the same consequence on a machine as it is to an infantryman. As it appears to be only a matter of thickness for the "shield" to resist even the highest velocity bullets, there would appear to be a chance for remarkable developments in the protection of not only the pilot and passengers of aircraft, but in the more vital parts of the machine itself. Sir Arthur Conan Doyle calculates that from 40 to 70 per cent. of the minor casualties of the war might be saved by its use. An enquiry addressed to the County Chemical Co., Bradford Street, Birmingham, upon the subject should lead to a good "life investment" for those likely to be strafing the Hun from the air in the near future.



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